METRONMD
User Manual

Version 7.07 © EponaTech LLC 2013

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Use of the Manual

The Metron-MD software is designed to meet international quality and performance standards. Personnel operating the software must have a thorough understanding of the proper operation of the software.

This guide has been prepared to aid medical and technical personnel to understand and operate the software. Do not operate the software before reading this manual and gaining a clear understanding of the operation of the software. If any part of this manual is not clear, please contact EponaTech LLC or your equipment dealer's representative for clarification.

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Metron-MD has been granted FDA K-number K103554

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DATA PRIVACY
Author of the SOFTWARE PRODUCT, has the rights to use the data content and images to enhance the comparative database used with the SOFTWARE PRODUCT. This data will be used in an aggregate form and will not be distinguishable per individual patient.

Conventions Used in this Manual

WARNING: warning points out procedures that you must follow precisely to avoid damage to the system in the form of loss of data, or corruption of files in the software.

NOTE: Notes provide additional information, such as expanded explanations, hints, or reminders.

IMPORTANT: Important highlights critical policy information that affects how you use this manual and this product.

Metron Desktop PC or Laptop System Requirements – Minimum

Below are the minimum requirements for the Metron software to operate but may not display images at the speed and image quality you might need.

Operating System
Windows XP Pro 32-bit, Windows 7 or Windows 8.

Make sure the acquisition device supports the specific operating system; some of the older devices. Older X-Ray devices are like printers – many older printers will not work on new computers with Windows 7 or Windows 8.

Graphics System and Monitor | Desktop PC
Widescreen 20+" monitor with a minimum resolution of 1600 x 1200 or greater / 60 Hz, image contrast ratio – 800:1 (the higher the better), and response time of 8 ms or better plus an independent graphics card with 512MB is strongly recommended for best image presentation quality.

Graphics System and Monitor | Laptop
Laptop should have a 17 inch screen for best display of X-Rays. Display resolution of 1600x900 or greater with High Definition Anti-Glare display strongly recommended.

RAM
Computers running Windows XP Pro will perform best with at least 2GB of RAM. Computers running Windows 7 or newer operating system will perform best with at least 4GB of RAM.

Disk Space
To install Metron and have needed space for the images, the desktop PC or laptop must have at least 200GB of available disk space. Consider 350GB-1TB disk. Also consider the new Solid State Drive (SSD) for laptops used in mobile laboratory application. They are more tolerant of rough use.

Processor Speed
Metron will typically perform better on newer/faster desktop PC or laptop. To maximize the speed/efficiency of the Metron program, and your overall image processing/viewing experience, use the fastest desktop PC or laptop possible.

Internet Connection
High speed Internet connection availability is required for any desktop PC or laptop that will be running Metron. The internet connection is critical for training & support. New software releases are also provided automatically via internet. Also, with Metron, you can send diagnostic images electronically to a remote radiologist; this is not possible without an Internet connection.

WARNING: Failure to ensure that the host computer satisfies the above-stated minimum requirements may cause Metron to be unacceptably slow or cause user interface elements to be off-screen and un-viewable, or other problems with operation.

Quick Start Guide

Thank you for your purchase of Metron Software. This guide will walk you through the simple process of installing Metron Software.

1. Load the CD (if applicable)

Load the CD into the CD Drive of your computer. The CD should auto-start and present you with an informative installation screen. If it does not start automatically, navigate to the CD using Explorer or My Computer and double click on "Metron.exe."

2. Run a Downloaded Installer (if applicable)

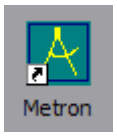
If you do not have a CD, but have downloaded a Metron installer file, simply double-click this file to launch the installer. If you were given two installer files (one for 'code' and one for 'data', run both of them before attempting to enter Metron).

For a new install of Metron on a computer that it has never been installed on, you are required to run the provided 'Data Installer'. If it is an 'upgrade' install for a previously installed copy of Metron, there is no need to run the 'Data Installer'.

WARNING: Failure to run the provided 'Data Installer' during a first-time install of Metron will result in an incomplete installation of the software. If you are not sure if the 'Data Installer' was previously run, always run it again (it does no harm to run it additional times).

3. Starting the Software

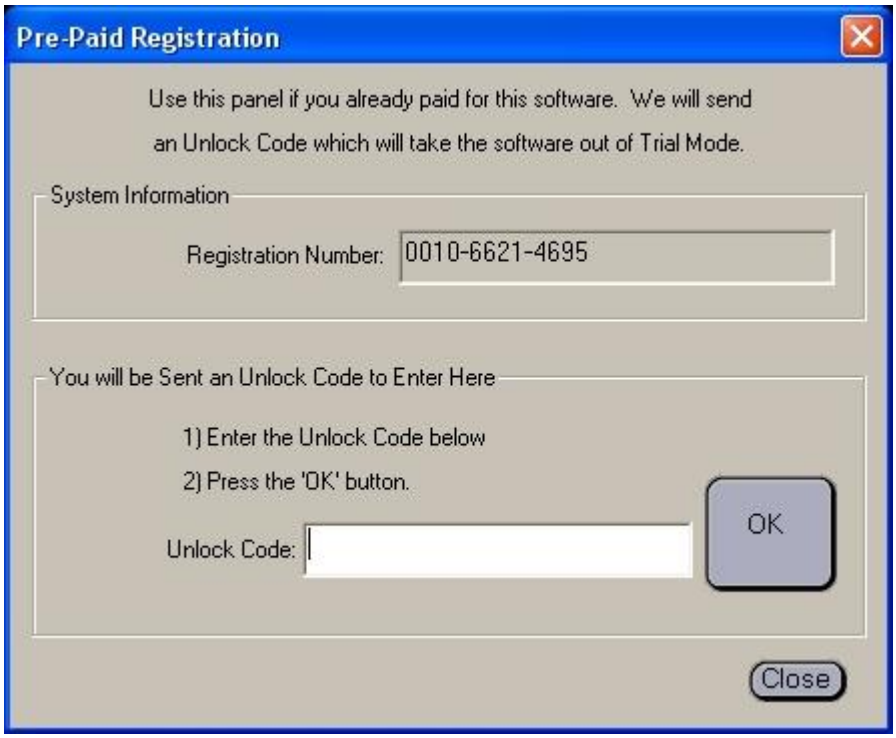
After the software has installed, you will find new icons on your desktop. There are shortcuts to the Metron manuals and the shortcut to start the Metron software:



Double-click the Metron software icon and Metron will start in trial mode.

4. Unlocking the Software

4.1) Start up Metron. In the "top-bar" (the menus across the very top of the screen) click on the "Register" option, and then choose the "Pre-Paid" choice.


Pre-Paid Registration
Use this panel if you already paid for this software. We will send
an Unlock Code which will take the software out of Trial Mode.
System Information
Registration Number:
0010-6621-4695
You will be Sent an Unlock Code to Enter Here
1) Enter the Unlock Code below
2) Press the 'OK' button.
Unlock Code:
OK
Close

4.2) Contact your software dealer or EponaTech LLC to obtain the Unlock Code. They will need the "Registration Number" shown on the panel, along with information on who the end-user of Metron will be.

4.3) Once you get the Unlock Code, enter it in the space provided near the bottom of the above panel, then click on the "OK" button.

4.4) Use the "Check Status" choice under the "Register" pull-down to check if your software is now enabled. You're done.

WARNING: Failure to unlock the Metron software will leave your system in "Trial Mode" which is not fully functional.

Starting Metron

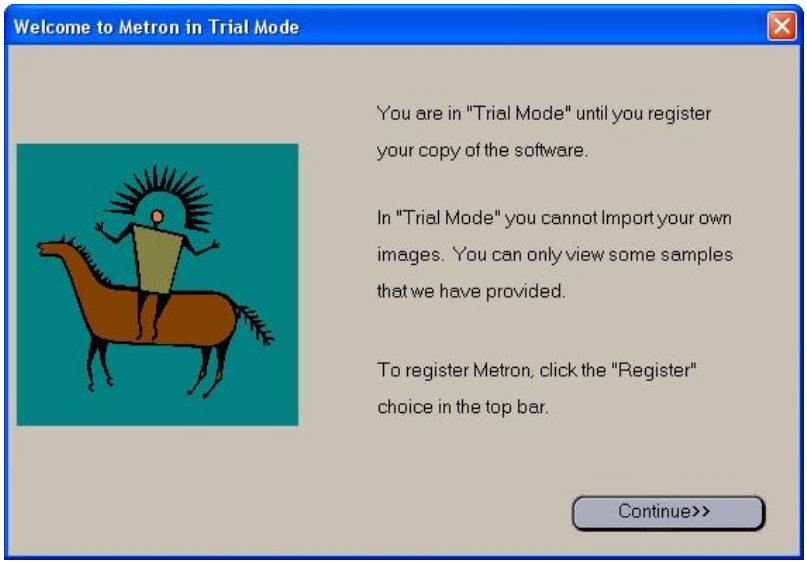
The installation program has placed an icon on your desktop that looks like this:

Double clicking the icon will start Metron. If the icon does not appear on your desktop, you can start Metron by going to the "Start" button (extreme lower left on your computer screen), then choosing "Programs", and then choosing "EponaTech" and then "Metron".

The installation program also places an icon on your desktop called "Metron Guide" which is a shortcut to this document.

When Metron Starts Up

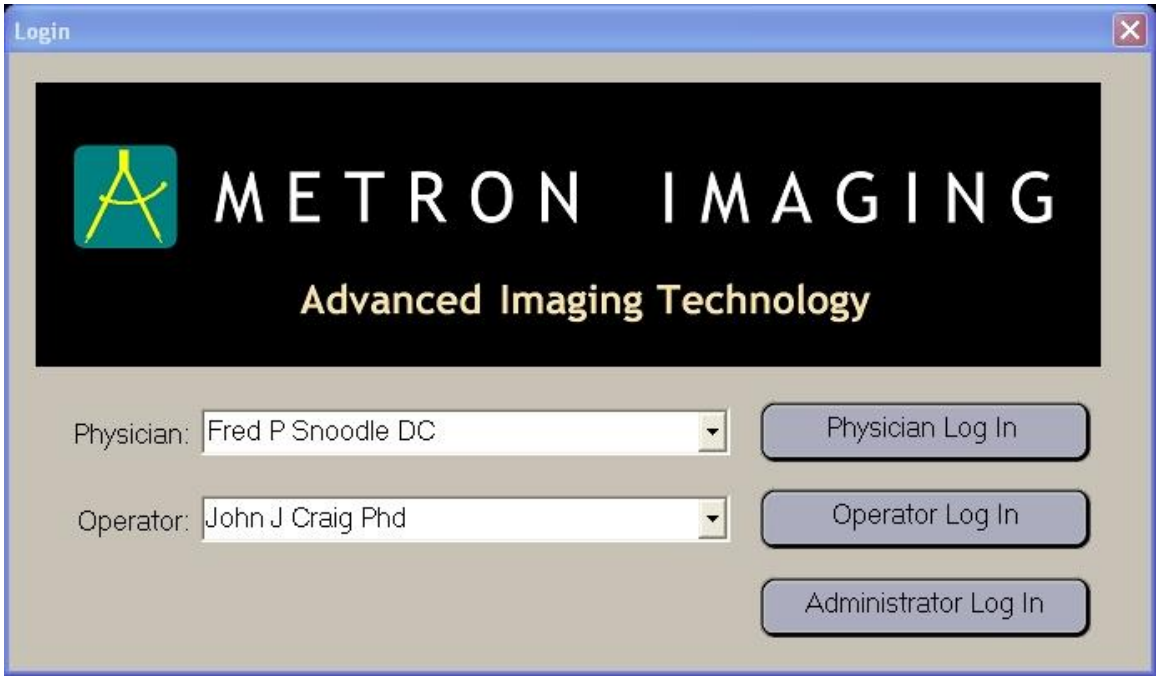
When you first start up Metron, you will see a panel informing you that you are in "Trial Mode". In Trial Mode you will find many features of Metron are blocked to you. But, you may be able to explore Metron a little bit and get a feel for it.


Welcome to Metron in Trial Mode
You are in "Trial Mode" until you register your copy of the software.
In "Trial Mode" you cannot Import your own images. You can only view some samples that we have provided.
To register Metron, click the "Register" choice in the top bar.
Continue>>

If you have already purchased Metron, the company you purchased it from can supply you with an "Unlock Code" which will take you out of Trial Mode and fully enable Metron.

The Log-In Screen

Once unlocked and enabled, Metron-MD always starts by displaying the Log-In screen. Users may log-in at three different levels: Operator, Physician, or Administrator. There is only one administrator account. Logging in as Administrator gives you the ability to set up other user accounts and passwords. The Administrator can also restrict privileges for certain operations within Metron. For example, an Operator may be able to delete an image, but may be restricted from performing a permanent delete from the Trashcan.



In a new installation of Metron-MD, it is recommended that the first time the Log-In screen pops up, the administrator should log-in and assign their password, and set up accounts for other users.

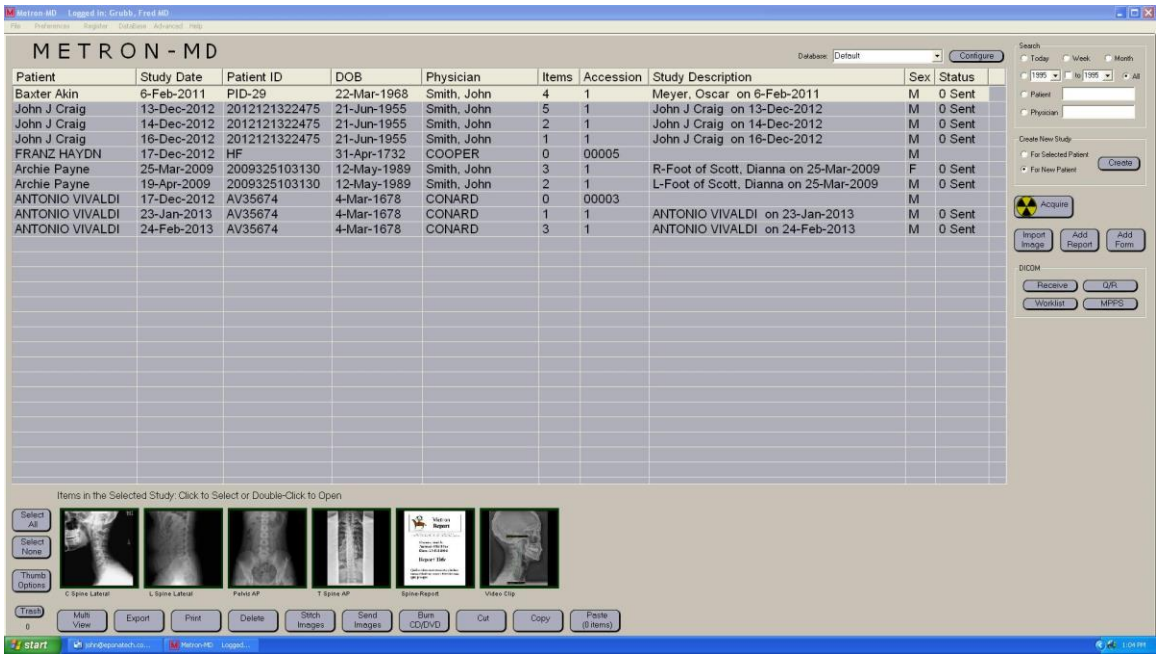
Note that when an Operator logs in, it is implied that he is working under the supervision of the Physician that is displayed on the log-in screen.

The currently logged-in user of Metron is displayed in the upper blue-bar around that main Metron window.

An image acquired by Metron-controlled hardware will be tagged with the logged-in user at the time of acquisition. This information can later be seen by right-clicking on a thumbnail and clicking the "Info" button.

The Study List Screen

Metron always starts in the Study List screen. This is where you can browse and find all images, video clips, and reports in your Metron database. The study list screen always shows thumbnails (small images) for all the items in the selected study.

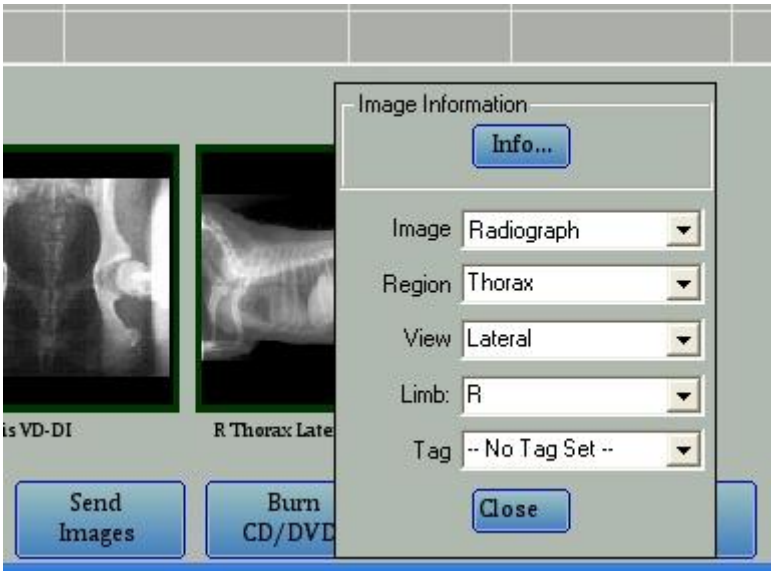

METRON-MD
Patient | Study Date | Patient ID | DOB | Physician | Items | Accession | Study Description | Sex | Status
Baxter Akin | 6-Feb-2011 | PID-29 | 22-Mar-1968 | Smith, John | 4 | 1 | Meyer, Oscar on 6-Feb-2011 | M | 0 Sent
John J Craig | 13-Dec-2012 | 2012121322475 | 21-Jun-1955 | Smith, John | 5 | 1 | John J Craig on 13-Dec-2012 | M | 0 Sent
John J Craig | 14-Dec-2012 | 2012121322475 | 21-Jun-1955 | Smith, John | 2 | 1 | John J Craig on 14-Dec-2012 | M | 0 Sent
John J Craig | 16-Dec-2012 | 2012121322475 | 21-Jun-1955 | Smith, John | 1 | 1 | John J Craig on 16-Dec-2012 | M | 0 Sent
FRANZ HAYDN | 17-Dec-2012 | HF | 31-Apr-1732 | COOPER | 0 | 00005 | | M |
Archie Payne | 25-Mar-2009 | 2009325103130 | 12-May-1989 | Smith, John | 3 | 1 | R-Foot of Scott, Dianna on 25-Mar-2009 | F | 0 Sent
Archie Payne | 19-Apr-2009 | 2009325103130 | 12-May-1989 | Smith, John | 2 | 1 | L-Foot of Scott, Dianna on 25-Mar-2009 | M | 0 Sent
ANTONIO VIVALDI | 17-Dec-2012 | AV35674 | 4-Mar-1678 | CONARD | 0 | 00003 | | M |
ANTONIO VIVALDI | 23-Jan-2013 | AV35674 | 4-Mar-1678 | CONARD | 1 | 1 | ANTONIO VIVALDI on 23-Jan-2013 | M | 0 Sent
ANTONIO VIVALDI | 24-Feb-2013 | AV35674 | 4-Mar-1678 | CONARD | 3 | 1 | ANTONIO VIVALDI on 24-Feb-2013 | M | 0 Sent
Items in the Selected Study: Click to Select or Double-Click to Open

The Study List Screen

The Study List screen is like the "home page" of Metron. You always start here, and you often come back to it. The database consists mostly of images, but can also contain video clips, and reports. Additionally, there is something called a form, which is an image, but it is created from several individual images arranged in a certain pattern.

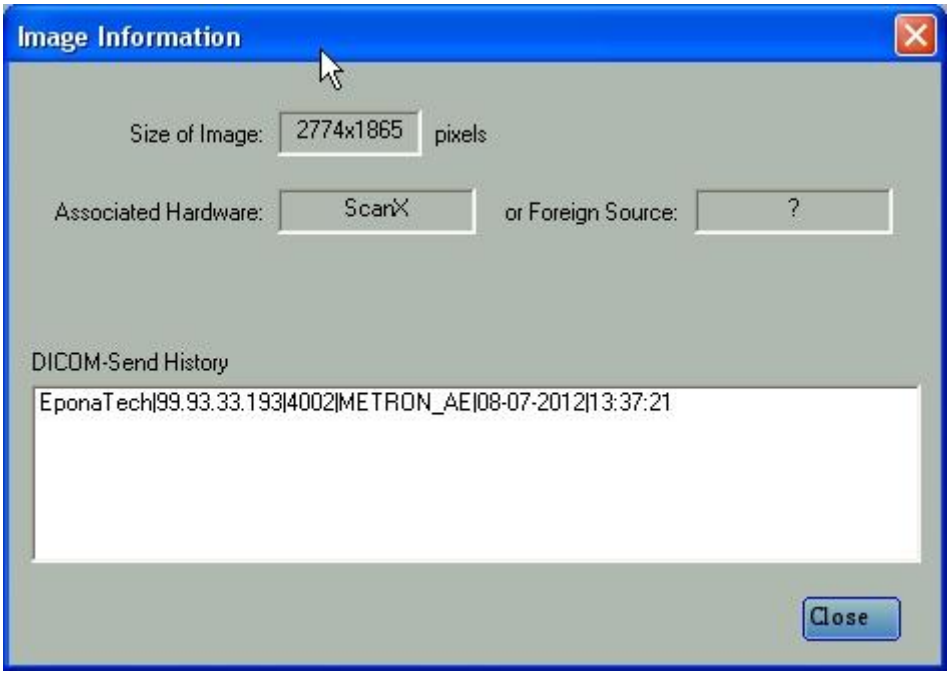
Left to right: An Image, a Report, a Video Clip, and a Form.

You may right click on an image thumbnail to see some information about it (for example, its dimension sin pixels).



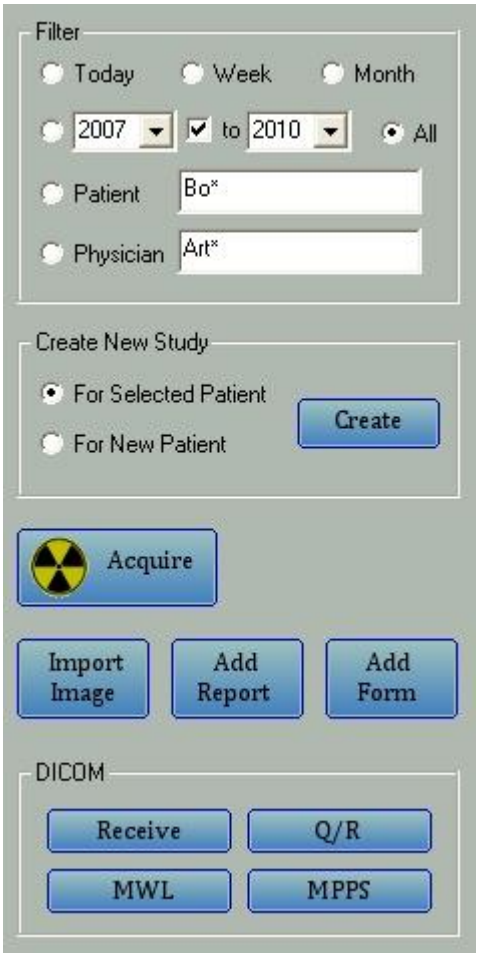
Right-click on an image thumbnail

The "Info" button will show you further information, including a history of where and when this image was DICOM-sent out of Metron.



Information including the DICOM-Send History for any image.

To the side of the list of studies is a set of items shown below. The top section is where you may specify a "Filter" so that the study list only contains studies from a certain year, or only the ones created in the last week, etc.



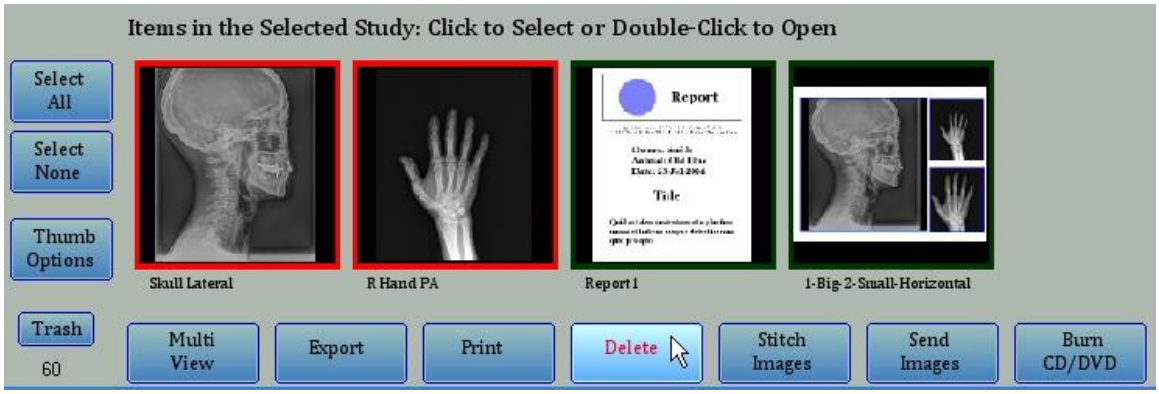
The next section lets you create a new study – either for an existing animal or a new animal.

Finally there are a set of DICOM tools: The "Receive" button will blink red if a DICOM image has been sent to your copy of Metron (unless a "Routing Rule" has been set up in which case the received images go directly into your database). The "Q/R" button lets you query and retrieve images from a remote PACs. The "MWL" button lets you query a remote PACs for a worklist, and "MPPS" is used to tell that PACs that you have completed a request imaging task.

NOTE: Your study list panel may appear with a different icon as that shown above, depending which imaging hardware your copy of Metron is configured for.

NOTE: Under "Preferences" you can choose whether names are displayed in format of "Last-comma-First" or not.

Multi-Image Operations



An important concept behind the Metron user interface is that you can perform some operations on multiple images at a time, whereas other operations only make sense to perform on one image at a time. Any time you want to perform an action on several images at once, the place you do that is the row of buttons along the bottom of the screen. You specify the images by single-clicking on the thumbnails, which will turn the border of the thumbnail red, showing that it is selected. For example, as in the image above, you can highlight two images in the study, and then click "Delete" to delete them.

For example, click on 6 thumbnails to highlight them with a red border; then click the button labeled "Multi View". You will see those 6 images side by side as below:

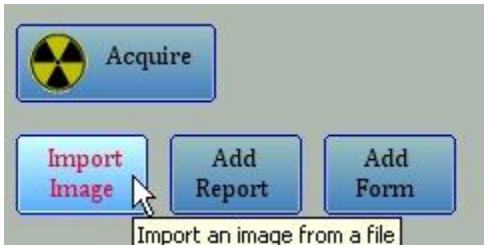
In multi-view, below each image, you are able to zoom, and you can choose to turn off or on any "mark up" that is drawn over the image.

Other multi-image operations that you can do are:

- Delete a group of highlighted images
- Export a group of images (that is, write them out to your disk in whatever image format you choose (JPEG, Bitmap, DICOM, etc)
- Print a group of images (you can choose how many per page to print)
- Stitch 2 or more images into a single image (Appendix C)
- Send images by DICOM (see later section in this manual)
- Burn some images to a DVD or CD

Just above the buttons that perform operations on multiple images at once are three buttons that can be used to help you highlight, or select, which images you want to do the operation to. You can "Select All", "Select None", or "Select Next Region". The "Select Next" button will highlight all images from a certain anatomical zone, and subsequent clicks to this button will step through the various anatomical zones found in the study.

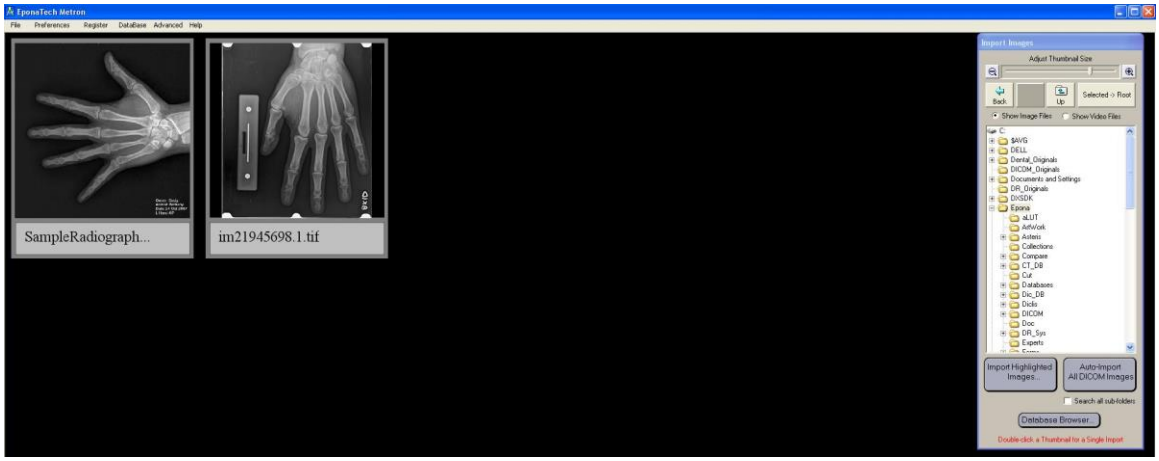
Adding Images into your Metron Database



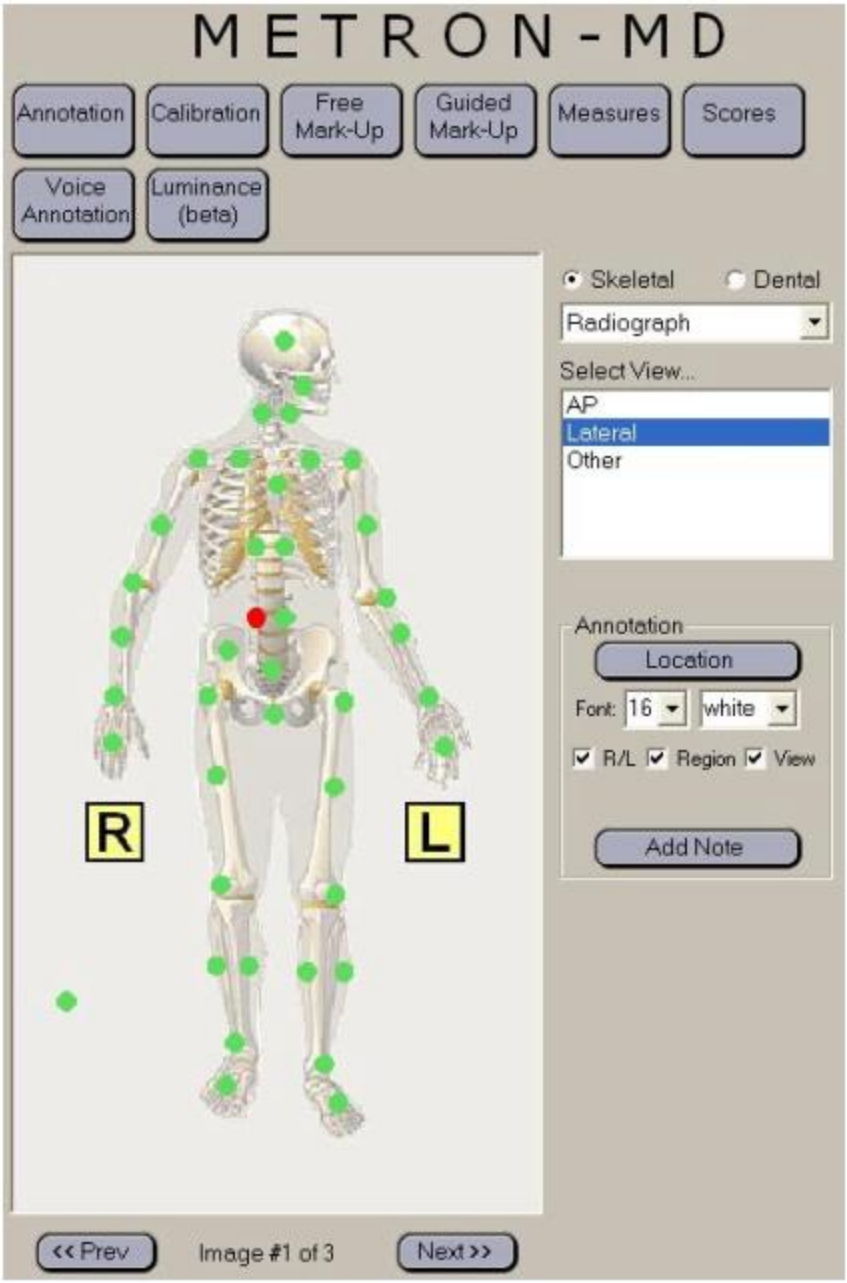
If your Metron software came as part of a DR or CR system, there will be an icon labeled "Acquire" as shown above which you will click in order to acquire new radiographs. The button "Add Form…" lets you add a Form to your study, and the button "Add Report…" lets you create a report and add it to your study. The button "Import Image" is the way to import any image file on your PC into Metron, and also any *.avi video file can be imported this way.

Importing Images from Files

To import images from a digital camera or from any other source, you start by clicking on the "Import Image". This will bring up a display of thumbnails. They are not in Metron yet – you are simply viewing image files that happen to be on your computer's disk. On the right hand side of the screen is a "folder Browser" which you use to navigate to any folder on your computer (indeed to any folder anywhere on your office network – as long as remote disks are mounted with "drive letters" on your PC)



You can double-click one thumbnail to bring it into Metron, or you may highlight a group of images and then click the button "Import highlighted Images…". This brings to a screen in which you see one image at a time in its full size, and with the "Anatomy Diagram" shown on the right hand portion of the screen:



Click on the appropriate anatomical zone (one of the green dots) to indicate to Metron what anatomy is in the image you are importing into Metron. Additionally, there is a list in which you select the "View" that best describes the image (e.g. Lateral, DP, etc). You can adjust the size and location of the annotation on the image as well. When complete, click the button "Accept into Metron" to finalize bringing the image into Metron. If you had selected several images, you would now see the next one; repeat the procedure of labeling the anatomy and view of each image.

WARNING: It is up to the operator of Metron to properly choose the anatomy and view corresponding to the image that has been acquired. Failure to do this labeling properly will result in an image with an inaccurate annotation label.

Single Image Tools

When an image is in Metron and you view it alone on the screen, you can perform various operations on the image. You get into "Single Image View/Edit" immediately after importing a new image into Metron, or by double-clicking any image thumbnail from the Database Browser screen. The single image operations are entered by clicking on the large buttons just below the "Metron-MD" label and above the anatomy chart. The number of buttons will depend on the kind of image that you are viewing. Not all operations are available on all image types.

In the example below, there are these operations available:

- Annotation: All images have this feature which lets you pick the anatomy and view
- Calibration: Prior to making measurements in images, you need to calibrate
- Free Mark-Up: A set of tools that let you make measurements and add notes to an image
- Guided Mark-Up: This is only available for certain anatomical shots for which Metron support a guided mark-up analysis (e.g. Lumbar Spine lateral, Cervical Spine lateral).
- Measures: Only available if Guided Mark-Up is available – this is where the results of the mark-up are found
- Normals: Only available if Guided Mark-Up is available – this is where normal zones are displayed.
- Voice Annotation: Connect a microphone to your PC and you can record comments for an image

WARNING: Metron provides several methods to calibrate images. Failure to carefully follow calibration procedures may result in the inability to make accurate measurements in the affected image(s).

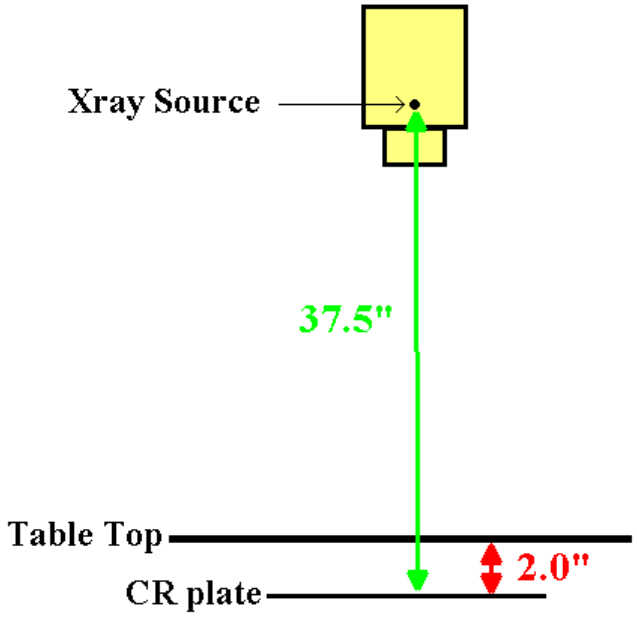
In the single image view/edit screen, a row of buttons across the bottom of the screen provide image filtering tools and other functions.

Image Calibration

Due to the nature of the geometry of radiographic imaging, all radiographs have inherent *magnification* in them. For example, if one puts a ruler on a radiographic film, the measurements one would get are not true size of the radiographed objects, but rather they would measure larger than actual size.

Example: Table Arrangement

The figure below shows the physical setup (patient on a table). The two numbers shown are constant.



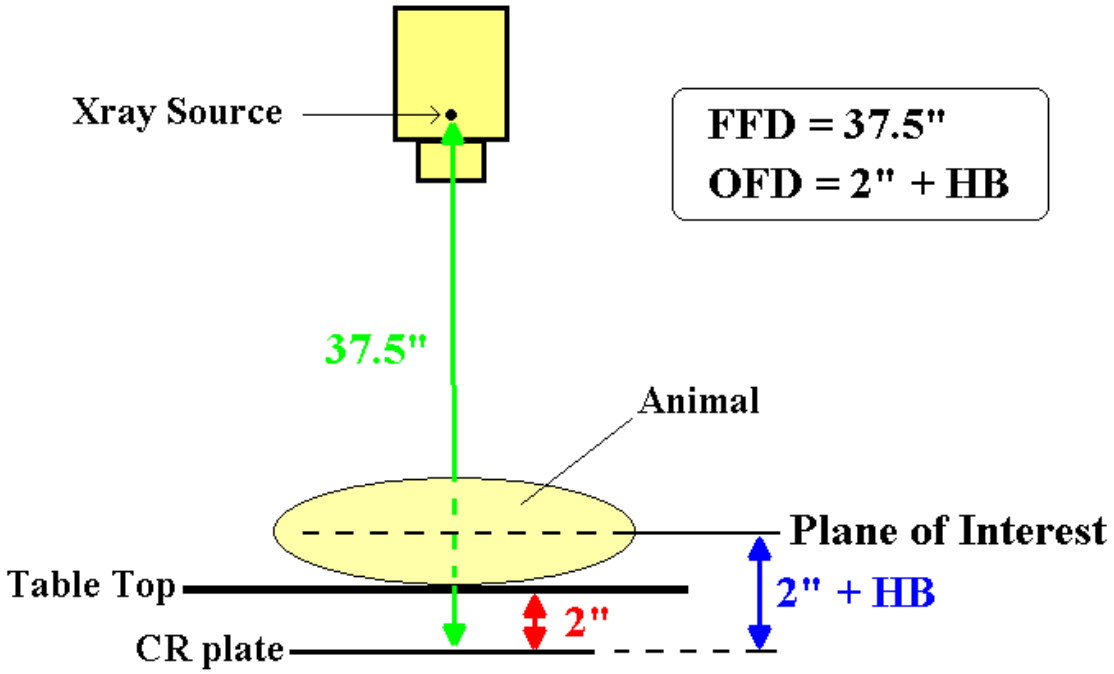
The two fixed offsets of importance in a table setup. Where "CR plate" is indicated, it could instead be a DR flat plate, CCD technology, or film.

Concept: The "Plane of Interest"

To be precise with radiographic calibration, it is not possible to simply program constant offsets into the imaging software. This is because it is subject-dependent and view or procedure dependent exactly where the calibration is needed. An important concept is the "plane of interest" which is a plane, parallel to the imaging plate, but offset some distance towards the generator. Calibration can be used so that accurate measurements can be made in this plane of interest. But, this requires that

A) The practitioner decide where the "plane of interest" should be, and
B) The imaging software must be told where this "plane of interest" is located.

For example, for a human lying on their side on a table, the best general choice for the plane of interest would be at about half the body thickness – approximately the plane containing the spine. However, if you were shooting radiographs intended for pre-surgical planning for the knee, or some other specific anatomy, the ideal choice for the plane of interest is the plane most nearly containing those anatomical features you intend to measure. The figure below shows the best general plane for a person lying on the table. Of course, this is just an example, and the same applies for a subject standing in front of a wall-mounted detector, and so forth.



The best general choice is to locate the "plane of interest" at a distance above the table corresponding to half of the subject's thickness.

FFD, OFD, and Magnification Factor

In the Metron software we use the terms Film Focal Distance (FFD) and Object Film Distance (OFD) to describe the physical set up and location of the plane of interest. The FFD is the distance from the source of X-rays to the imaging plate, and OFD is the distance from the plane of interest to the imaging plate.

Given these values, the magnification factor evident in the radiograph is:

$$\mathbf{M = \frac{FFD}{FFD - OFD}}$$

For example, for a subject that is 6" thick (so "HB" in figure 2 is 3") we have the values:

FFD = 37.5"
OFD = 5.0"

Which gives a magnification factor of 1.154. This means everything in the image is 11.54% bigger than true size. For all the films you shot on this system, if you were to measure with a ruler on the film, a 10" distance along the spine would measure 11.54" with your ruler.

Pragmatism and General Use

A great majority of radiographs of interest are not used for measurements in any way, so none of these issues of calibration matter at all.

However, in some procedures measurements are important. It is also our belief that the small amount of extra effort that must be expended to ensure calibrated images should be expended for all images as a matter of standard practice. Clinics spend a great deal of money for diagnostic imaging, and they should be able to have the benefit of accurate measurements in the images obtained.

The current state of the art is that very few practitioners think about calibration, and support for it in the major CR and DR systems on the market is generally lacking. The solution adopted by some vendors is simply to add a line to the radiograph's annotation that states "Scale is approximate".

Radiographic Calibration in Metron

Metron supports several schemes to achieve calibration due to the number of different systems and situations we work in. In some schemes, knowledge of the FFD and OFD are not required at all – but these schemes require that a special marker was placed in the plane of interest when the image was acquired.

Metron-Scaler…
The easiest and best ways of calibrating require a marker of known size placed "in the plane of interest". To this end we sell a little widget called the "Metron-Scaler" which works well. It can be Velcro-strapped to a leg, or placed at 'mid body' or, if super-accurate calibration not required, can simply be placed on the table (hence, lower than 'mid body').

The "Metron-Scaler" will be automatically located by the Metron software (most of the time - something obstructs it or if the exposure is off, it may not find it, then you simply pick two points on it and you are calibrated.)

Pick 2 Points…
Next easiest is something metallic of your own that you may have that could be placed. In this case, Metron won't automatically find it, but you can use the calibration option to "Pick 2 Points" that are a known distance apart and you are calibrated -- so, very easy.

Known Pixel-Pitch…
Now on to ways that require knowledge of FFD and OFD:

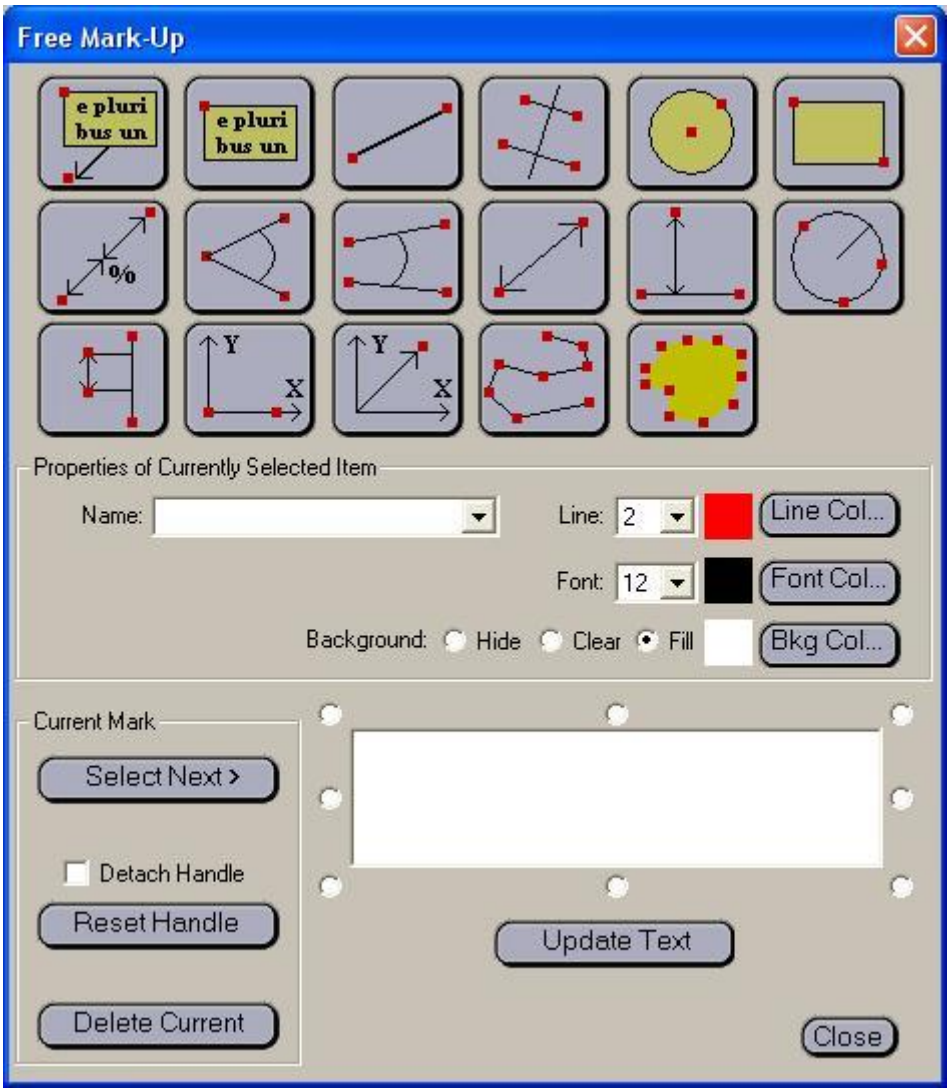
If there is no scale marker "in the plane of interest" then the only way to get calibrated is to know the relationship between pixels and physical length on the CR or DR plate, and also to know the FFD and OFD so that Metron can do the math to transform all measurement into a plane parallel to the CR or DR plate, but offset from it (the "plane of interest"). This is known as the "Known Pixel Pitch" method of calibration.

In the case of CR, Metron knows the scan setting used. In the case of DR, Metron knows the pixel spacing of the detector plate. But to transform the measurements (that is, to "take the magnification out") we must have the FFD and OFD, and this is entered into the calibration panel. In case you want an approximate plane of interest always to be a certain height off or your table, you can enter these values once, and you'll see that Metron will "remember" values put in for FFD and OFD from session to session.

WARNING: Metron provides several methods to calibrate images. Failure to carefully follow calibration procedures may result in the inability to make accurate measurements in the affected image(s).

Free Mark-Up

The Free Mark-Up panel provides a number of different measuring and annotation options.



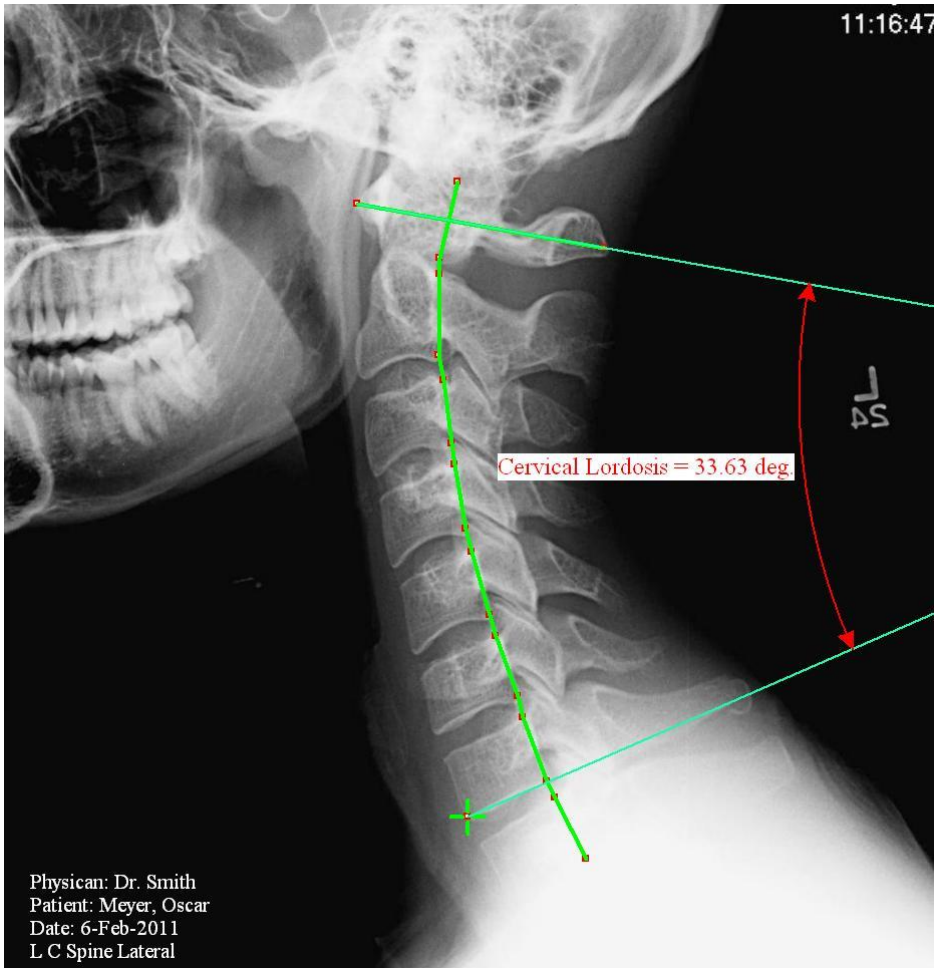
NOTE: If you elected not to calibrate the current image, then many of the measurement tools shown above will be absent from this panel.

Guided Mark-Up

Metron supports a process we call "Guided Mark-Up" in order to provide a uniform way to analyze certain types of images. For example, if you have a lateral radiograph of the cervical spine or of the lumbar spine, or an AP image of the spine, or of the pelvis, Metron supports guided mark-up of these images.

The idea in guided mark-up is to follow the instructions and pick the key points in the image as Metron guides you to. Then, Metron computes several parameters from these points that were picked. Then, you choose which set of measurements you wish to display overlaid on the image. Selecting all makes quite a cluttered image, so generally you select 1 to 4 measurements that are of importance for the particular case.

Appendix D provides a step-by-step illustration of the guided markup process using a real lateral lumbar spine radiograph as an example.



Sample guided mark-up results for the cervical spine. This image shows just 1 of 10 measurements that Metron reports for this analysis.

Sample guided mark-up results for the lateral lumbar spine radiograph. This image shows just 1 of the 10 measurements that Metron computes for this image.

⚠ WARNING

WARNING: Failure to follow the directions given for Guided Mark-Up and/or lack of care in picking the key points can result in loss of accuracy of the resulting computed values.

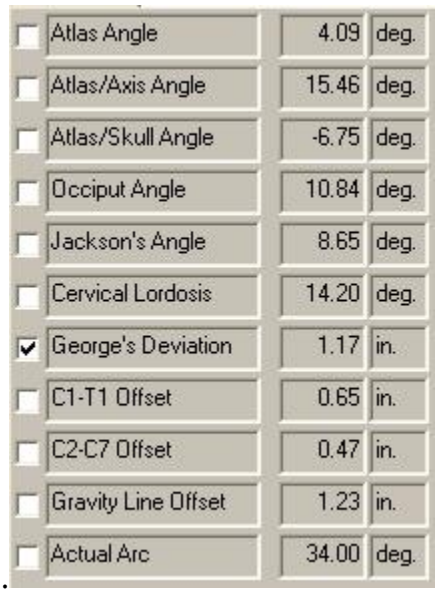
Analysis of the Lateral Cervical Radiograph

There are a series of 6 instructions to follow in order to pick key points on the lateral radiograph of the cervical spine. These 6 steps are:

1. Pick 2 points on the posterior body of each vertebra from C1 down to T1
2. Pick anterior inferior on C4 and anterior superior on C5
3. Pick the anterior inferior point on C7
4. Pick 2 points on Atlas to specify its main axis
5. Pick 2 points to specify skull base at level of foramen magnum
6. Pick one point at the anterior lip of the sella turcica

It is up to the user's medical training and best judgment to pick these points in the correct locations.

After completion of the guided mark-up picking for a lateral radiograph of the cervical vertebra, a set of 11 measures are computed. A sample set of numbers are shown below.


Atlas Angle 4.09 deg.
Atlas/Axis Angle 15.46 deg.
Atlas/Skull Angle -6.75 deg.
Occiput Angle 10.84 deg.
Jackson's Angle 8.65 deg.
Cervical Lordosis 14.20 deg.
George's Deviation 1.17 in.
C1-T1 Offset 0.65 in.
C2-C7 Offset 0.47 in.
Gravity Line Offset 1.23 in.
Actual Arc 34.00 deg.

*The 11 measurements computed for the lateral **cervical** radiograph. Click the small box to the left of the parameter name, and the measurement is visualized on the radiograph with overlaid markup, which makes it easy to understand its meaning.*

Note that for proper interpretation of these measures, the patient must be positioned appropriately. Here are some brief notes and comments on each of the measures:

Atlas Angle: The angle that the major axis of C1 (from this aspect) makes with the horizontal.

Atlas/Axis Angle: The perpendicular to the posterior side of the C2 body is constructed, and the angle between this constructed line and the major axis of C1.

Atlas/Skull Angle: The angle between a line at the base of the skull (at the level of the foramen magnum) and the major axis of C1.

Occiput Angle: The angle between a line at the base of the skull (at the level of the foramen magnum) and the horizontal.

Jackson's Angle: The angle between two constructed lines: one at the posterior of the body of C2, and the other at the posterior of the body of C7.

Cervical Lordosis: The angle between two constructed lines: one along the major axis of C1, and the other along the inferior side of the body of C7.

George's Deviation: George's line is the curve created by connection points chosen on the posterior sides of all vertebral bodies. According to some literature, in the ideal case these points lie on a circular arc. Metron's "George's Deviation" parameter is a sum of all the offsets from this perfect circular arc. A perfect value would be zero (0.0) meaning that all points lie on a perfect circular arc. The higher the value of this parameter, the more deviation there is from a circular arc. In blue, the "ideal arc" is shown.

C1-T1 Offset: Construct a line from the inferior posterior corner of the T1 body vertically in the image, and then measure horizontal displacement of the superior posterior corner of the C1 body. Some literature suggests this value be "small".

C2-C7 Offset: Construct a line from the inferior posterior corner of the C7 body vertically in the image, and then measure horizontal displacement of the superior posterior corner of the C2 body. Some literature suggests this value be "small".

Gravity Line Offset: Some literature suggests that a point at the anterior lip of the sella turcica serves as a good reference of the center of mass of the head, and further that a line dropped vertically from that point should pass "near" the disc space between C4 and C5. This parameter gives this measure.

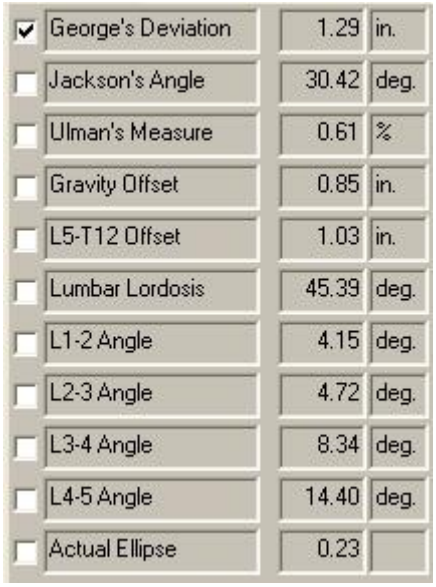
Actual Arc: Some literature suggests that the arc fitting thru the vertebrae should be a 42-degree section of a circle. This parameter shows the actual value of the best-fit arc.

Analysis of the Lateral Lumbar Radiograph
There are a series of 5 instructions to follow in order to pick key points on the lateral radiograph of the lumbar spine. These 5 steps are:

1. Pick 2 points on the posterior body of each vertebra from L5 up to T12
2. Pick 2 superior points on S1
3. Pick anterior inferior point on L5
4. Pick 2 points on the anterior body of L3
5. Pick 2 points on the anterior body of T12

It is up to the user's medical training and best judgment to pick these points in the correct locations.

After completion of the guided mark-up picking for a lateral radiograph of the lumbar vertebra, a set of 11 measures are computed. A sample set of numbers are shown below.



*The 11 measurements computed for the lateral **lumbar** radiograph. Click the small box to the left of the parameter name, and the measurement is visualized on the radiograph with overlaid markup, which makes it easy to understand its meaning.*

Note that for proper interpretation of these measures, the patient must be positioned appropriately. Here are some brief notes and comments on each of the measures:

George's Deviation: George's line is the curve created by connection points chosen on the posterior sides of all vertebral bodies. Some literature suggests that in the ideal case these points lie on a smooth curve which is a section of an ellipse with certain major-to-minor axis ratio. Metron's "George's Deviation" parameter is a sum of all the offsets from a best-fit elliptical arc. A perfect value would be zero (0.0) meaning that all points lie on an elliptical arc. The higher the value of this parameter, the more deviation there is from an elliptical arc. An "ideal" elliptical arc is drawn in blue.

Jackson's Angle: The angle between two constructed lines: one at the posterior of the body of L1, and the other at the posterior of the body of L5.

Ulman's Measure: A perpendicular to the sacral base line is created at the sacral promontory. L5 should be at or behind this line. Ulman's measure quantifies how far anterior to this line L5 lies in terms of a percentage of the vertebral body's size.

Gravity Offset: A vertical line is constructed from the centroid of the L3 body. Some literature suggests that this line should pass "near" the sacral promontory. The 'Gravity Offset' parameter measures this distance.

L5-T12 Offset: Construct a line from the inferior posterior corner of the L5 body vertically in the image, and then measure horizontal displacement of the inferior posterior corner of the T12 body. Some literature suggests this value be "small".

Lumbar Lordosis: The angle between two constructed lines: one along the inferior side of the T12 body, and the other along the sacral base line.

L1-2 Angle: The angular change in going from the L1 body to the L2 body - measured by comparing lines constructed along the posterior side of each vertebral body. Some literature suggests the ideal value is 2.5 degrees.

L2-3 Angle: The angular change in going from the L2 body to the L3 body - measured by comparing lines constructed along the posterior side of each vertebral body. Some literature suggests the ideal value is 6.3 degrees.

L3-4 Angle: The angular change in going from the L3 body to the L4 body – measured by comparing lines constructed along the posterior side of each vertebral body. Some literature suggests the ideal value is 9.7 degrees.

L4-5 Angle: The angular change in going from the L4 body to the L5 body – measured by comparing lines constructed along the posterior side of each vertebral body. Some literature suggests the ideal value is 15.9 degrees.

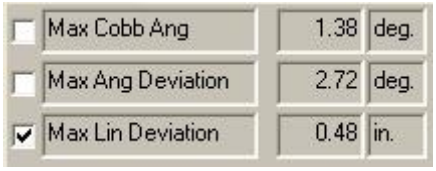
Actual Ellipse: This gives the minor-axis to major-axis ratio of the best-fit ellipse used in the Georges line deviation parameter. Some literature suggests that a normal value is 0.39.

Analysis of the AP Spine Radiographs
The following guided-markup analysis can be used for images of any of the three spine segments: Lumbar, Thoracic, or Cervical.

There is a single guided mark-up instruction to pick three points on each vertebral body. These picks are then repeated on as many vertebrae as desired. Two points are picked on symmetric features on each side of the vertebral body, and the third point is a centered feature, such as the spinous process.

It is up to the user's medical training and best judgment to pick these points in the correct locations.

After completion of the guided mark-up picking for a AP radiograph of the spine vertebra, a set of 3 measures are computed. A sample set of numbers are shown below.



The 3 measurements computed from the analysis of an AP view of the spine. Click the small box to the left of the parameter name, and the measurement is visualized on the radiograph with overlaid markup, which makes it easy to understand its meaning.

Max Cobb Angle: This is the largest angular difference between any two vertebrae.

Max Angular Deviation: This is the largest angular value (away from vertical) of any vertebra.

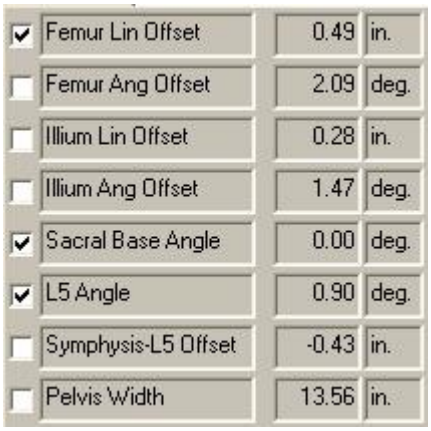
Max Linear Deviation: A vertical blue line is drawn on the image starting at the center of the lowest vertebra picked. This is the largest distance horizontally away from this central line of the center of any vertebra.

Analysis of the AP Pelvis Radiograph
There are a series of 5 instructions to follow in order to pick key points on the lateral radiograph of the lumbar spine. These 5 steps are:

1. Pick 2 points: highest points on each side of the illium
2. Pick 2 points to indicate the top of the sacrum
3. Pick the four corners of the L5 vertebral body
4. Pick 2 points: the tops of the femur heads
5. Pick 1 point at the symphysis

It is up to the user's medical training and best judgment to pick these points in the correct locations.

After completion of the guided mark-up picking for a lateral radiograph of the lumbar vertebra, a set of 8 measures are computed. A sample set of numbers are shown below:


Femur Lin Offset 0.49 in.
Femur Ang Offset 2.09 deg.
Illium Lin Offset 0.28 in.
Illium Ang Offset 1.47 deg.
Sacral Base Angle 0.00 deg.
L5 Angle 0.90 deg.
Symphysis-L5 Offset -0.43 in.
Pelvis Width 13.56 in.

The 8 measurements computed from the analysis of an AP view of the pelvis. Click the small box to the left of the parameter name, and the measurement is visualized on the radiograph with overlaid markup, which makes it easy to understand its meaning.

Femur Linear Offset: This is the difference in vertical height between the tops of the femur heads.

Femur Angular Ofset: This is the angle that the line connecting the tops of the femur heads makes with a horizontal.

Illium Linear Offset: This is the difference in vertical height between the tops of the Ilium.

Illium Angular Ofset: This is the angle that the line connecting the tops of the left and right Ilium makes with a horizontal.

Sacral Base Angle: This is the angle made by the base of the sacrum relative to the horizontal.

L5 Angle: This is the angle made by the base of L5 relative to the horizontal.

Symphsis-L5 Offset: This is the horizontal offset from the center of the L5 body to the center of the symphsis.

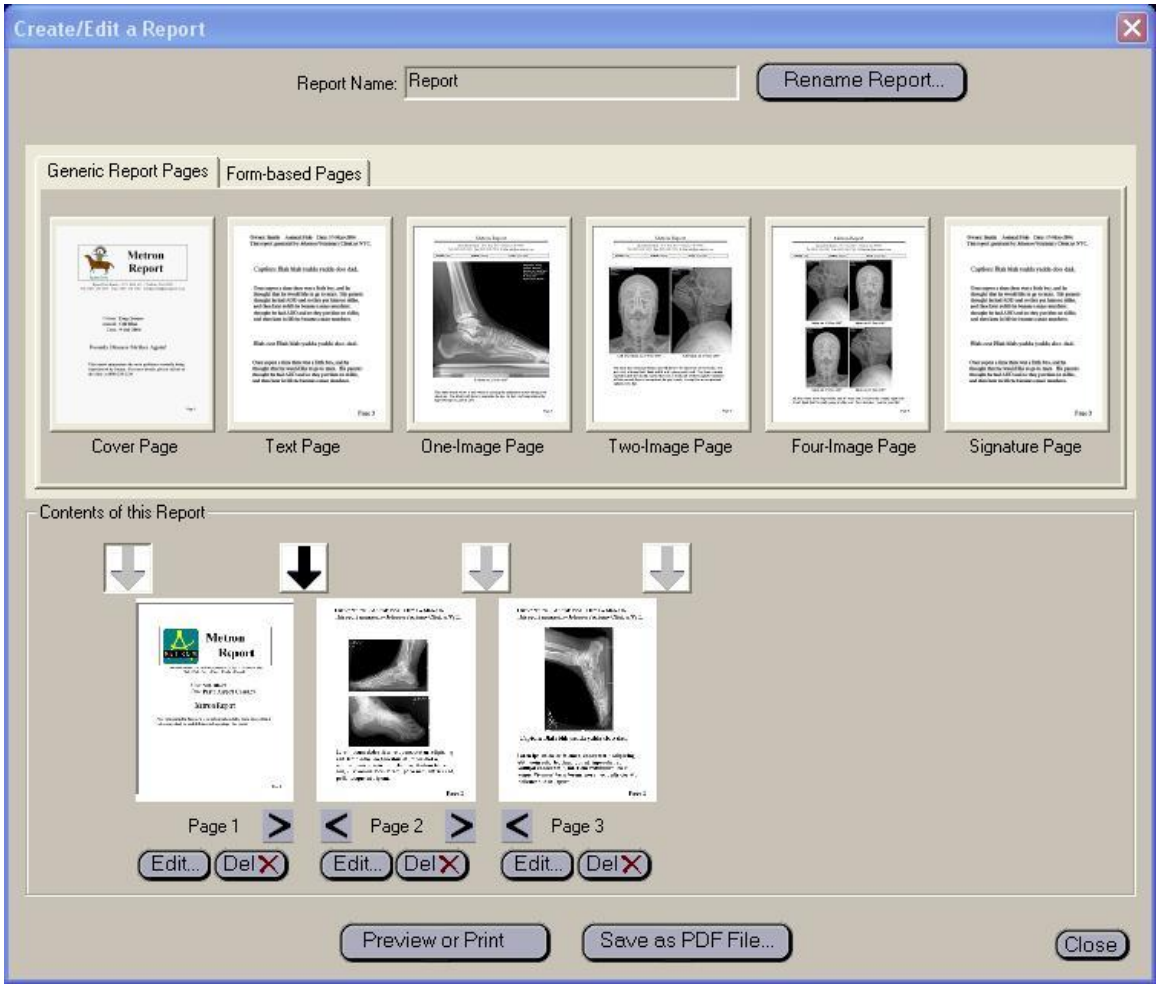
Pelvis Width: This is the distance between the tops of the femur heads.

WARNING: It is the responsibility of the Metron user to interpret the results of the guided mark-up analysis. EponaTech LLC assumes no liability for the improper use of these results. Metron software is a tool to make physical measurements from calibrated images, it is not a diagnosis system. All diagnoses must be made by licensed professionals.

Report Creation

An important function of Metron is to generate reports. These reports are multi-page formatted reports containing images and text. Metron users create these reports for their clients and they are a vital communication tool.

The report generator panel is shown below. In this image, a report has already been constructed which consists of several pages.



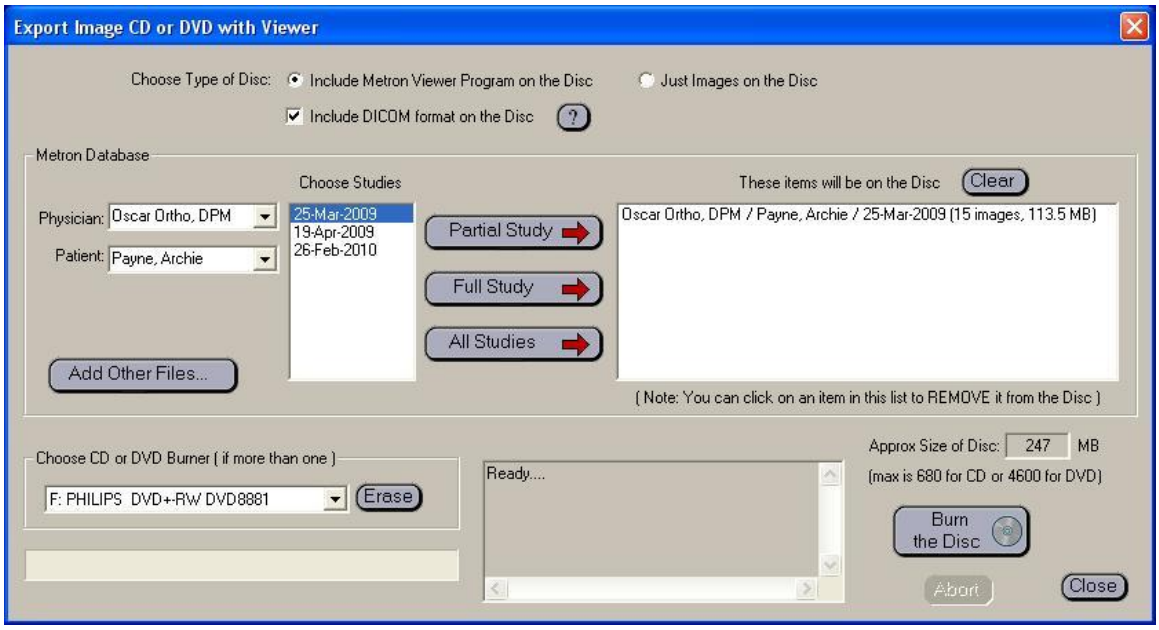
You create a report by choosing a page type, adding it to the report, and then using a page editor panel (its details depends on the type of page) to fill in the images and text on that page. Pages come from 2 main categories, represented by the 2 tabs in the upper portion of the repot generator panel: “Generic Pages”, and “Form Pages”. Most reports are built from “Generic Pages”; the “Form Pages” allow multiple images to be laid out on a page in various ways. Users can create their own forms to get particular layouts of interest.

Reports in Metron can be re-opened and edited at any time. From the report generator panel you can choose to export a report as a PDF file (the free Adobe Acrobat software is need to view these). If you burn a CD or DVD in Metron and include a report in the

study that goes onto the disk, it will automatically be converted to a PDF file and put on the disc. This way, the recipient of your CD will not be able to edit the report. Likewise, you can e-mail a report directly from your Metron database, and it will be converted to a PDF file and attached to the e-mail. There is also a choice in the e-mail panel which will let you send a report (as well as anything else in your Metron database) by e-mail to another Metron user who will then be able to bring the items into their own copy of Metron. In that case, it is not a PDF file that is sent, but a fully editable report.

Burn CD or DVD

Another important function is to burn a CD or DVD with images and other items to be given to another person. The panel is shown below:


Export Image CD or DVD with Viewer
Choose Type of Disc:
Include Metron Viewer Program on the Disc
Just Images on the Disc
Include DICOM format on the Disc
Metron Database
Choose Studies
These items will be on the Disc
Clear
Physician: Oscar Ortho, DPM
Patient: Payne, Archie
25-Mar-2009
19-Apr-2009
26-Feb-2010
Partial Study
Full Study
All Studies
Oscar Ortho, DPM / Payne, Archie / 25-Mar-2009 (15 images, 113.5 MB)
Add Other Files...
(Note: You can click on an item in this list to REMOVE it from the Disc)
Choose CD or DVD Burner (if more than one)
F: PHILIPS DVD+-RW DVD8881
Erase
Ready....
Approx Size of Disc: 247 MB
(max is 680 for CD or 4600 for DVD)
Burn the Disc
Abort
Close

By default, the CD or DVD created by Metron will also contain a "mini-Metron" viewer so that the recipient of the disk can view the images and reports easily.

To write a "partial study" onto a CD, highlight the thumbnails of the images you want to select prior to entering the Burn CD panel. From within the panel, you can include additional full studies on the disk.

There is an option at the top of the panel to write a disk without the min-Metron viewer, but rather with images only. If you choose this style of disk, you can select the format of the images: JPEG, TIFF, or DICOM.

Export and Import of Metron Databases

There are several reasons why you might want to import or export an entire Metron database, or a portion of one. For example:

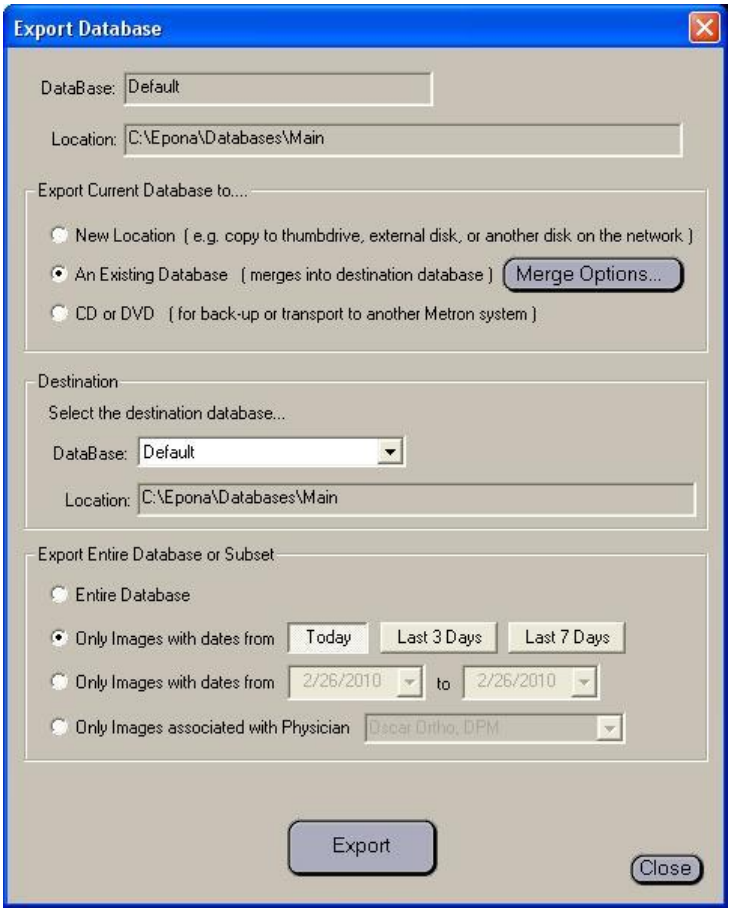
- To make a back-up of your database, export a copy of it to another disk
- To merge images from a portable Metron-based system that went out into the field back into your main database at your office
- To give a copy of part or all of your database to a colleague.

These things are found under the "Database" entry in the top-bar of Metron.

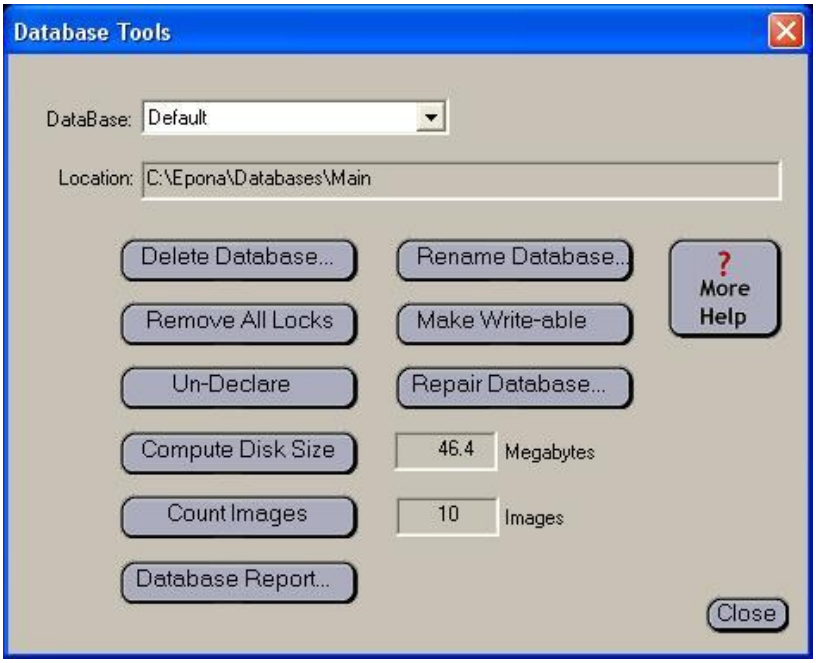
It is important to note that in the upper right hand corner of the Database Browser the "current database" you are viewing is shown. This is usually "Default". Some Metron users will only ever have this database. In fact, unless there is a good reason to have multiple databases, it is simplest to just have one. In the database tools, the terms "Export" and "Import" are always meant relative to the current Metron database. That is, you "export out of" the current database, or "import into" the current database.

You can export your database or a portion of it onto a thumb-drive, then carry it to another computer with Metron, then import from the thumb-drive into the database of that Metron. In the Export Database panel, there is also the ability to export the current database to a CD or DVD. This is a way to accomplish a back-up of your database.

WARNING: It is up to the operator of Metron to perform timely back-ups of the Metron database and any other data of importance. Metron contains no automated back-up facility. Back-ups are the responsibility of the user or clinic staff.

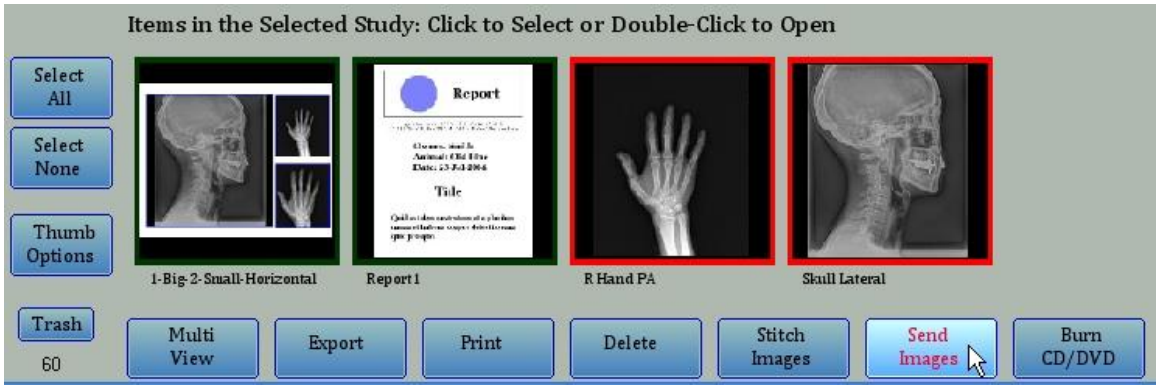

Export Database
DataBase: Default
Location: C:\Epona\Databases\Main
Export Current Database to....
New Location (e.g. copy to thumbdrive, external disk, or another disk on the network)
An Existing Database (merges into destination database)
Merge Options...
CD or DVD (for back-up or transport to another Metron system)
Destination
Select the destination database...
DataBase: Default
Location: C:\Epona\Databases\Main
Export Entire Database or Subset
Entire Database
Only Images with dates from
Today
Last 3 Days
Last 7 Days
Only Images with dates from 2/26/2010 to 2/26/2010
Only Images associated with Physician
Export
Close

A subset of the entire database can be specified by giving a range of dates of the studies. It is often convenient to export only the studies created in, say, the prior week and merge them into some other database.



The "Database Tools" panel gives you a way to count how many images are in your database, and to see the total size your images occupy on disk.

Sending Images out of Metron



To send images out of Metron via the internet, click "Send Images"

In order to send by DICOM, first go to "Preferences", then choose "DICOM Preferences" and then configure a server to which you will send. You will have to ask the recipient for the coordinates of their server.

You may also post images to www.MetronWebViewer.com for your colleagues to view there. All images posted to our server are encrypted and userid and password protected at the web-site.

Lossy Compression and Compression Ratios

By default, Metron-MD does not apply image compression. So, the general user will not create nor view images which have been compressed in any way.

However, Metron-MD does provide some image compression tools which an end-user may choose to apply.

There are 2 places in Metron-MD where image compression might be applied, these are:

1) When sending images via DICOM send

2) When saving an image to a file, when JPEG is selected.

Here is compression-ratio information for both of these situations:

1) DICOM send

By default when a DICOM server is specified in Metron, the transfer syntax is set to code 2, which stands for 'Implicit Little Endian', and the image is sent in full-fidelity with no compression applied. If the user so chooses, he may select a different setting for transfer syntax. If any method is chosen which applies compression, the user is able to specify the desired compression ratio by giving a number between 2 and 255, where 2 specifies the least compression, and 255 specifies the most compression. In such cases the compression ratio in effect is approximately the value specified divided by 5. That is, a value of 100 would specify a 20-to-1 compression ratio. Such a formula is approximate, as it depends on the particular image content (images with little detail can be highly compressed, whereas image with lots of detail do not compress by as high a ratio).

2) When saving an image as a JPEG

These images are saved as JPEG images with a fixed quality metric of 95%, which corresponds to a compression ratio of approximately 8-to-1. This is not user-adjustable.

Appendix A: DICOM Support in Metron

1. Introduction

Metron supports the DICOM standard. A "DICOM Conformance Statement" is available at http://www.metron-imaging.com.

2. DICOM File I/O

Metron can import and export a DICOM files in exactly the same way as it imports and exports files of types like jpeg, bitmap, or tiff. When you browse your disk looking for images from Metron, thumbnails appear for each folder that you select, and DICOM images will be displayed just like the other image types.

When importing image files into Metron, look for the button labeled "Auto-Import all DICOM Images" -- this will import all the DICOM images found in a selected folder, and will use the information in the DICOM tags to place them into the Metron database. At any time, click on the "Receive Images" button (in the Database Browser panel) to see a log showing where all imported DICOM images have been stored in Metron.

Likewise, anyplace in Metron where you are allowed to “Export” images or “Save As…” an image, you will find “DICOM” on the list of possible output formats.

The simple reading and writing of DICOM files is the most basic support for DICOM. But DICOM also specifies a communication protocol for sending and receiving images across a local network or the internet, and these topics are addressed in the next sections.

3. DICOM Send

Metron supports the “DICOM Send” functionality, allowing any image in Metron to be sent to any other DICOM-compliant product located anywhere on the internet.

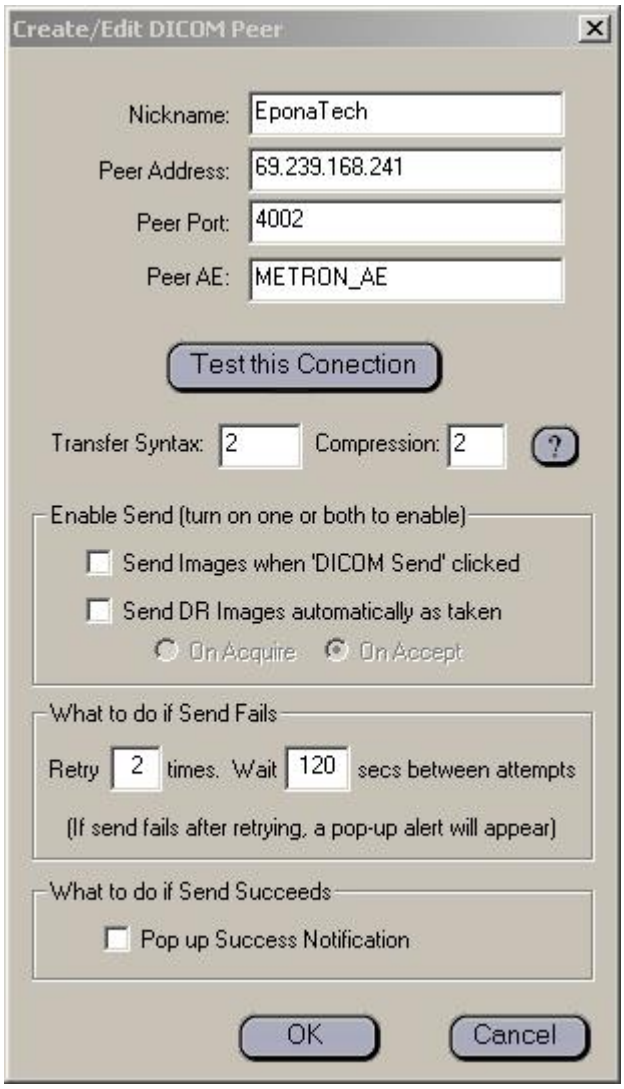
To prepare to send via DICOM, you must first define a DICOM system that you will send to. This is done by going to "Preferences" in the top-bar, then choose "DICOM Preferences". On the "Servers" tab, you will see a list of all the DICOM systems that you have set up in Metron.

This panel lists all the servers you have configured Metron for. Additionally, you can indicate your favorite server to Query and Retrieve from, and your favorite server to fetch Worklists from.

A new DICOM system can be added to the list by clicking the "New…" button just to the right of the list, and a server can be removed by highlighting one and then clicking the "Del…" button. The settings for each server can be reviewed and possibly edited by highlighting one and clicking the "Edit…" button. Doing this brings up the DICOM Peer panel shown below.

⚠ WARNING

WARNING: Failure to properly configure the Peer address, Peer Port, and Peer AE Title will result in Metron's inability to send DICOM images to that server. Always click the "Test this Connection" button to ensure that these values have been properly specified.



Use this panel to define a new DICOM system, or edit one that you previously set up.

The Peer Address, Peer Port, and Peer AE values must be given to you by whoever you wish to send a DICOM image to. These three values specify a particular DICOM enabled product somewhere on your local network or out on the internet somewhere in the world. The "Nickname" is chosen by you as a handy way to remember what each of these DICOMs servers is. Once you have filled in the top portion of the panel, you can click the "Test This Connection" button to quickly check if the DICOM server can be found.

The next items are for specifying "Transfer Syntax" and "Compression". If you are unsure of these settings, you can set both values to "2" in order to send full-sized uncompressed images which will be of the highest quality (but perhaps large and slow to send). Click on the button labeled "?" to see other possible settings. You probably should discuss this with the person in charge of the DICOM system you are sending to,

as they may have a preference, or it may be the case that their DICOM system cannot accept all possible transfer syntaxes. Again, choosing "2" and "2" is a safe choice, and it is the default in Metron. Here is more information on the values that you can use for these two settings:

Use an integer code to select the desired transfer syntax:

2 = IMPLICIT_VR_LITTLE_ENDIAN = "1.2.840.10008.1.2"
21 = EXPLICIT_VR_LITTLE_ENDIAN = "1.2.840.10008.1.2.1"
22 = EXPLICIT_VR_BIG_ENDIAN = "1.2.840.10008.1.2.2"
25 = RLE_LOSSLESS = "1.2.840.10008.1.2.5"
2199 = DEFLATED_EXPLICIT_VR_LITTLE_ENDIAN = "1.2.840.10008.1.2.1.99"
2450 = JPEG_BASELINE_1 = "1.2.840.10008.1.2.4.50"
2451 = JPEG_EXTENDED_2_4 = "1.2.840.10008.1.2.4.51"
2452 = JPEG_EXTENDED_3_5 = "1.2.840.10008.1.2.4.52"
2453 = JPEG_SPECTRAL_NONHIER_6_8 = "1.2.840.10008.1.2.4.53"
2454 = JPEG_SPECTRAL_NONHIER_7_9 = "1.2.840.10008.1.2.4.54"
2455 = JPEG_FULL_NONHIER_10_12 = "1.2.840.10008.1.2.4.55"
2456 = JPEG_FULL_NONHIER_11_13 = "1.2.840.10008.1.2.4.56"
2457 = JPEG_LOSSLESS_NONHIER_14 = "1.2.840.10008.1.2.4.57"
2458 = JPEG_LOSSLESS_NONHIER_15 = "1.2.840.10008.1.2.4.58"
2459 = JPEG_EXTENDED_HIER_16_18 = "1.2.840.10008.1.2.4.59"
2460 = JPEG_EXTENDED_HIER_17_19 = "1.2.840.10008.1.2.4.60"
2461 = JPEG_SPECTRAL_HIER_20_22 = "1.2.840.10008.1.2.4.61"
2462 = JPEG_SPECTRAL_HIER_21_23 = "1.2.840.10008.1.2.4.62"
2463 = JPEG_FULL_HIER_24_26 = "1.2.840.10008.1.2.4.63"
2464 = JPEG_FULL_HIER_25_27 = "1.2.840.10008.1.2.4.64"
2465 = JPEG_LOSSLESS_HIER_PROCESS_28 = "1.2.840.10008.1.2.4.65"
2466 = JPEG_LOSSLESS_HIER_PROCESS_29 = "1.2.840.10008.1.2.4.66"
2470 = JPEG_LOSSLESS_NONHIER_14B = "1.2.840.10008.1.2.4.70"
2490 = JPEG2000_LOSSLESS_ONLY = "1.2.840.10008.1.2.4.90"
2491 = JPEG2000 = "1.2.840.10008.1.2.4.91"

For transfer syntaxes that use compression, you may specify how much compression to use by giving an integer on the range [2..255] where 2 specifies the least compression (highest quality) and 255 specifies the most compression. For transfer syntaxes which don't use compression this value is ignored.

WARNING: The default settings of 2 and 2 in the DICOM Peer panel will ensure that no compression of the image will occur. Some other choices (e.g. 2490 for the first setting) also employ "lossless" compression scheme with which full fidelity of the image is maintained. Some other settings may cause "lossy" compression to be used which may remove detail or contrast from the image, or may introduce artifacts.

Next, we can configure Metron to send to this particular recipient when the Metron user manually clicks a "DICOM Send" button, or, automatically when a CR or DR image is taken with Metron (This only available if you have a DR or CR system which is based on Metron). If you choose the "Auto-Send" option, you have the further option of having the image sent immediately when acquired, or only when the user clicks the "Accept" button. Use of the later allows the user to possible rotate, crop, and filter the image before pressing "Accept" to save the image locally and send it out via DICOM communications.

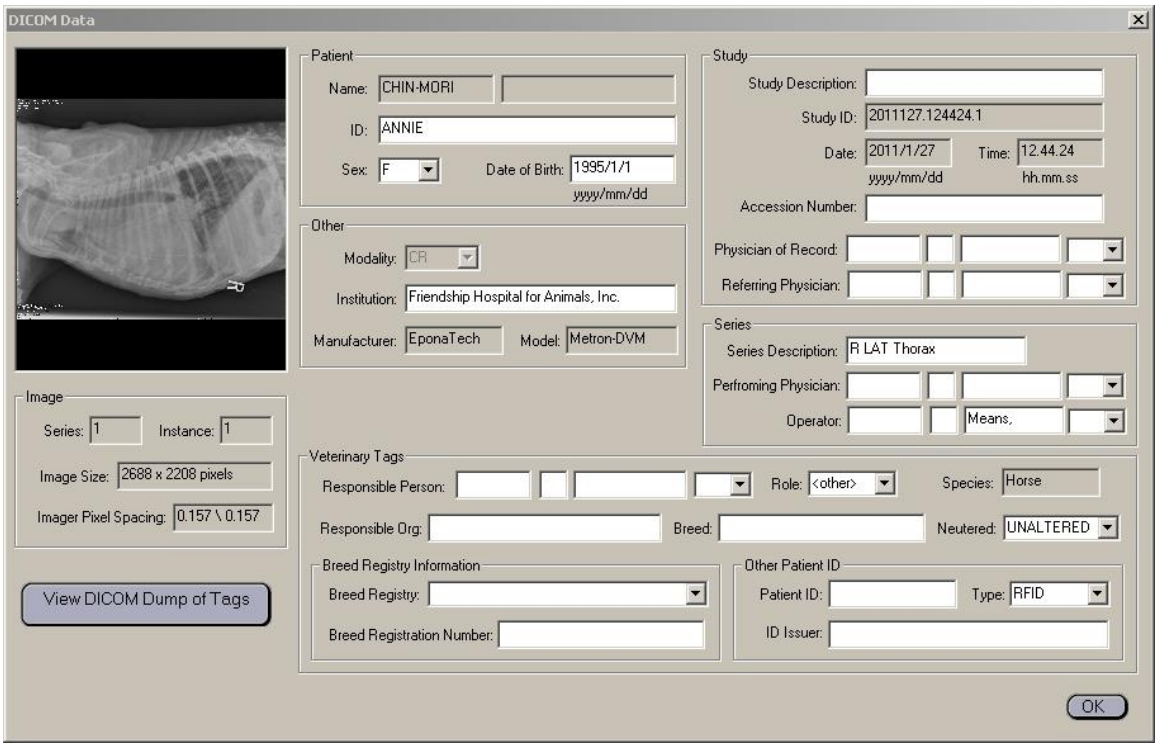
The last two items in the panel allow you to configure the behavior of the DICOM send function should the transmission fail, or should it succeed. Note that in any case you will ***always*** get a pop-up telling you of a transmission failure. The pop up telling you of success is optional (only downside: the click required to clear it off the screen after you see it). In addition to the failure pop-up and the optional success pop-up is a log file which is always kept in which you can review all the details of the DICOM sending activity.

The DICOM Send tab provides some controls and supports a log of all sends.

In the panel shown above, you can see where you can pop up the log file, or clear it out. Also, the panel shows how many images are in the queue waiting to be sent, and

there is an “Abort” button in the (unlikely) event that you decide you want to cancel the transmission of images awaiting being sent.

At the bottom of the panel, you see that you have a choice regarding viewing the “DICOM header tags” when you perform a DICOM send. Choosing “No” means the system won’t show you these tags at the time of sending at all – this choice minimizes mouse clicks, as otherwise you will use one or more mouse clicks to take this panel off the screen when a send occurs. If you select “Once per Study” then a panel showing the DICOM tags will pop up when you have clicked “DICOM Send” once for each study being sent. This gives you a chance to review the tags – if you spot something wrong, there is a “Cancel Send” button so you could cancel the send, got fix the tags, and then send again. The panel shown below shows the DICOM header tags.



The DICOM Data panel.

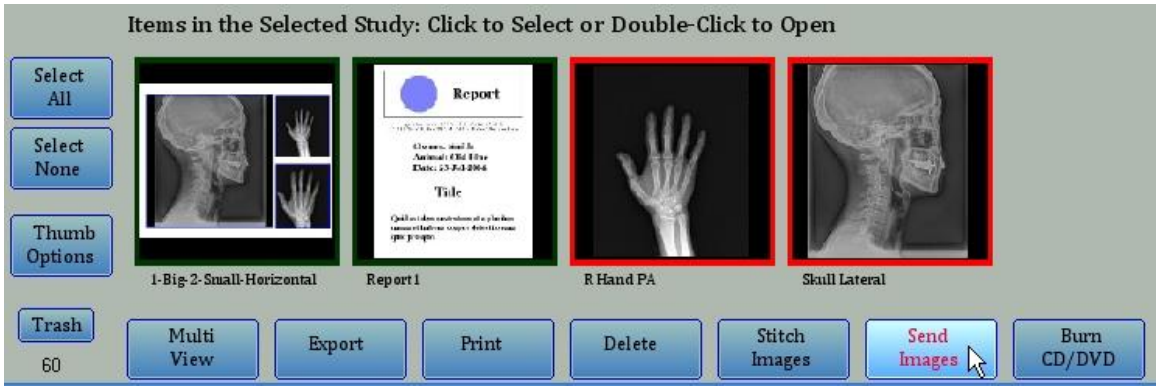
The most important tags are displayed in this panel. An item near the lower left portion of this panel lets you view all the tags supported by Metron. When you are viewing these tags during a “DICOM Send” operation, they are in read-only mode. If you see something you need to change, you’ll have to click “Cancel Send”, go edit the tag(s) and then again click “DICOM Send” to send the image(s). Editing of the tags is permitted when you see the “DICOM Data” button in Metron's “Single Image View” panel.

Since Metron, particularly when is used as acquisition software of a DR or CR system, is the source of DICOM images, we have the philosophy that the user is allowed to edit DICOM tags since the image is being created in Metron, and obviously the creator

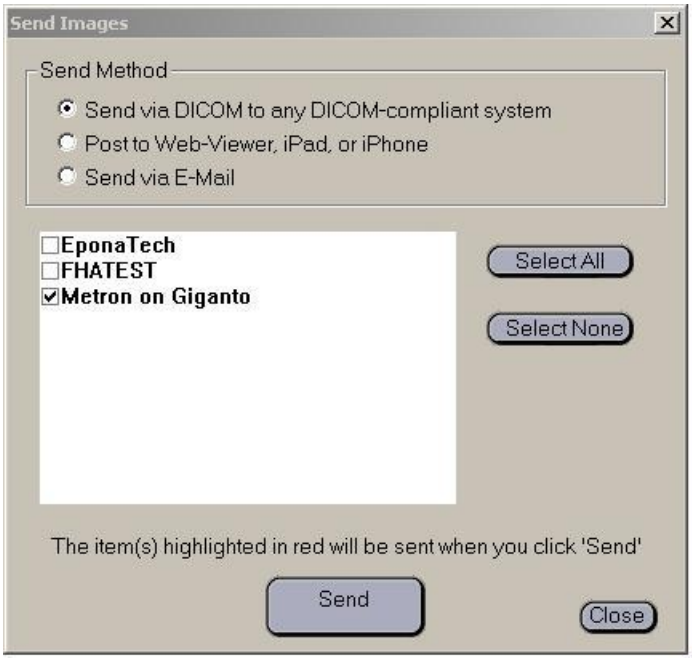
needs to be able to set the tags as needed. On the other hand, since Metron can import DICOM files that may have come from other DICOM sources, it is ***not*** recommended to edit the tags of those "foreign" DICOM files. While it is not strictly forbidden in Metron, the editing of tags of a foreign DICOM file in Metron causes a record to be kept in a special log file known as an Audit Trail. This would allow some responsible person to make a review and learn that Metron was used to alter DICOM tags in a foreign DICOM file.

Metron encapsulates all the "Metron specific" data such as calibration, free mark-up, and guided mark-up, etc inside a "Private Tag" in the DICOM file. If you send a DICOM file from Metron to another Metron user, the recipient will be able to receive the image, and all of its mark-up and data into their copy of Metron.

A DICOM Send is initiated from the main Database Browser panel of Metron by highlighting one or more thumbnail images, and clicking the "Send Images" button.



There are 3 ways to send images: DICOM, post to http://www.metronwebviewer.com, or by e-mail. You can select your default or favorite method in the general preferences panel, or simply choose the method each time you enter the Send Images panel.



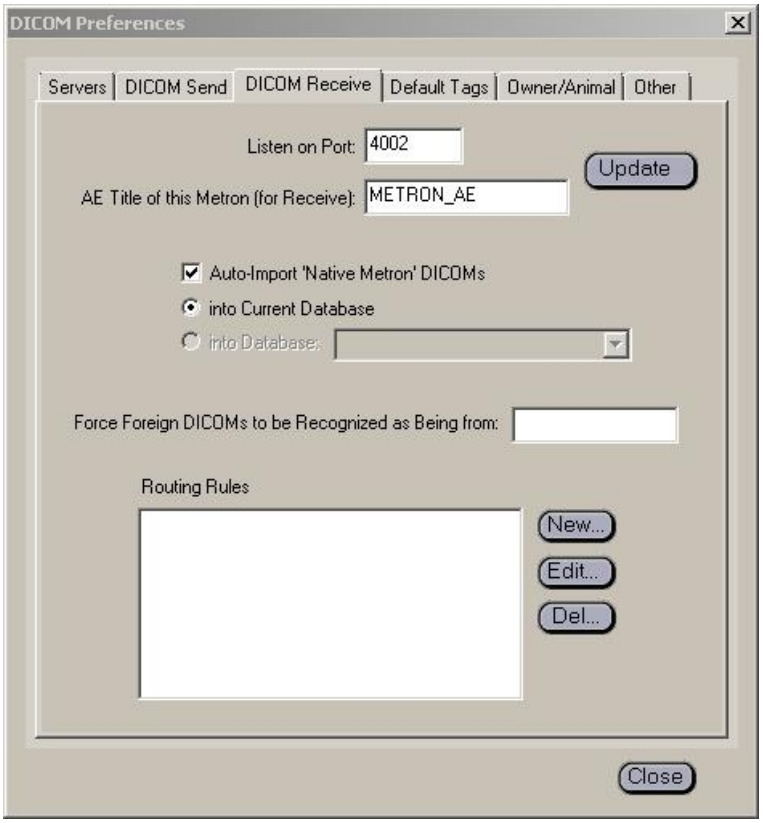
Mark the check box for one or more recipients and click 'Send'.

4. DICOM Receive

If DICOM images are sent to Metron, the “Receive Images” button in the Database Browser panel will begin to blink within 7 seconds of the image(s) arriving. By clicking on the Receive Images button you can see a transcript showing where they will go in Metron when you click on the “Import” button there. We will also discuss "auto-import" below - in this scheme the button does not blink and arriving images are silently accepted into your Metron database.

To configure the system which will send DICOM images to Metron, you need to know three things: the IP address of the PC that Metron runs on; the Port that Metron listens on (default value is 4002); and the name, or “AE Title” of Metron (default value is METRON_AE). With those three bits of information the system which will send images to Metron can be configured. The Port and AE Title used by Metron can be changed on the DICOM Receive tab if need be.

If you do not know the IP address of your computer, you can find out by going to the site http://www.ipchicken.com which will display your IP address.

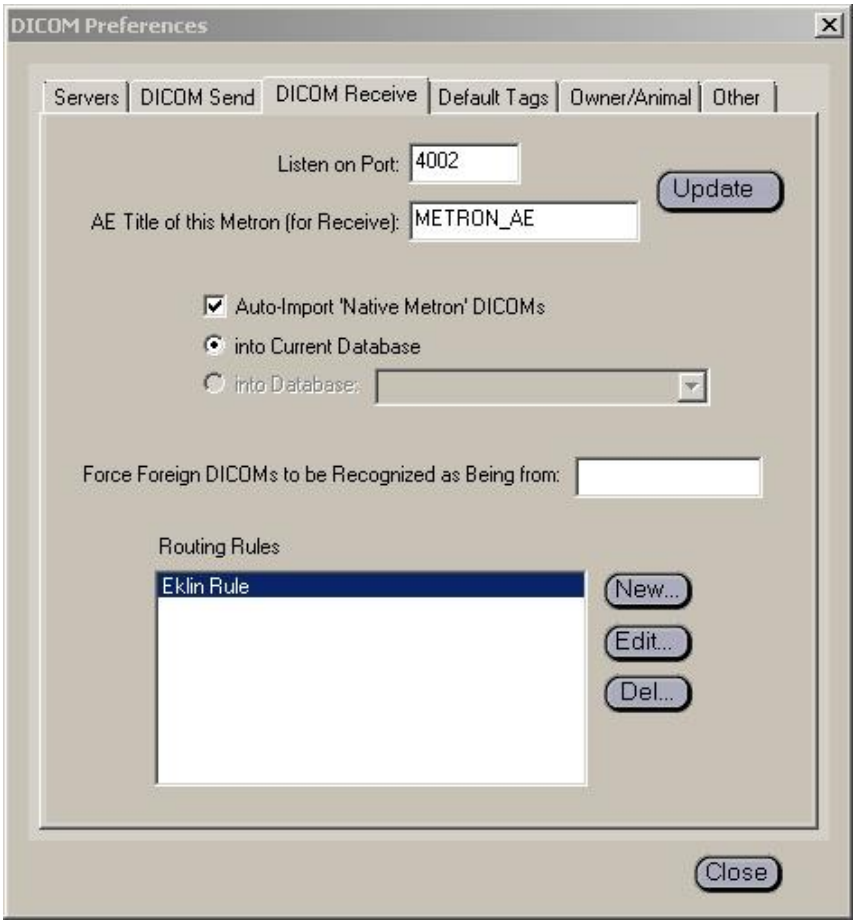


DICOM Receive tab: Configure auto-importing of native DICOMs and/or routing rules for recognized foreign DICOMs.

Receiving "Native DICOMs" and "Recognized Foreign DICOMs"

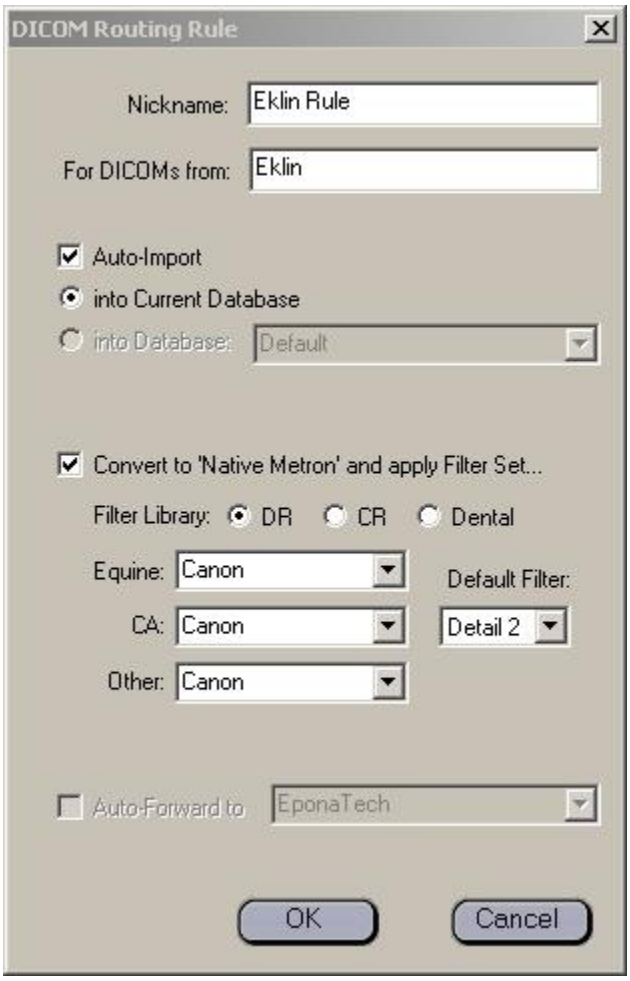
A "Native DICOM" is one which was created on a Metron system, and therefore it has the special 'private data tag' which holds all of the original Metron information (calibration, markup, measurements, etc). Generally it is a good idea to choose to auto-import them directly into the Metron database (this is the default setting). When Metron is configured to auto-import these DICOMs, their arrival will not cause the "Receive Images" button to blink red, rather, they will be silently and automatically inserted into the Metron database. A record of their auto-importation is kept in the Receive Images log, so you can always check the log and see that this has occurred.

A "Recognized Foreign DICOM" is one that did not originate from a Metron system, but it is from a system that Metron can recognize. For example, Metron knows how to tell that a DICOM file originated from an Eklin DR system. If Metron can recognize the source of the DICOM file, Metron can know where to look to find the anatomical region, and other details. Some of these details are not always in standard locations despite the DICOM standard.



DICOM Receive tab with a Routing Rule specified.

In the panel shown above, a "routing rule" has been created called "Eklin Rule". You click on the "New..." button to create a new routing rule, or click on "Edit..." to view or modify an existing routing rule. The panel below shows the definition of the "Eklin Rule":



Example of a Routing Rule.

The "Nickname" can be chosen as you wish. The important keyword "Eklin" has been inserted in the "For DICOMs from:" field. Please ask EponaTech if Metron knows how to recognize DICOMs from a particular system of interest, and what the corresponding keyword is for that system.

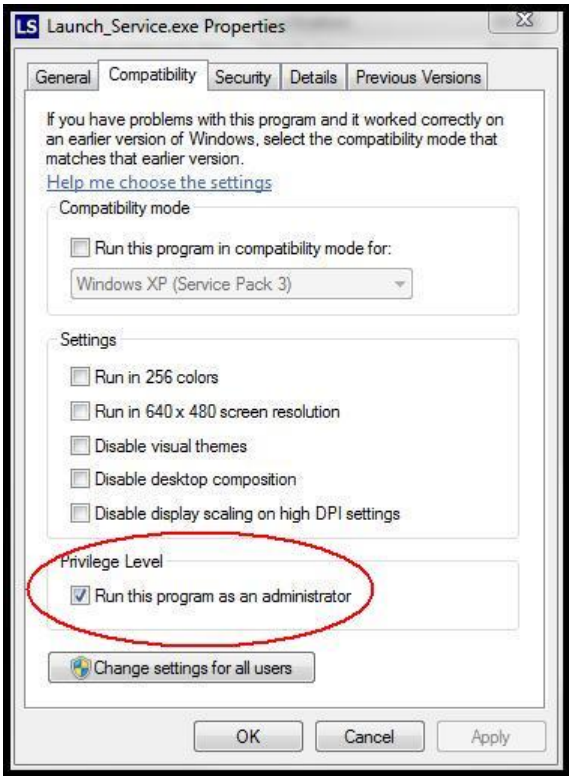
This routing rule says that if a DICOM arrives that is recognized as being from an Eklin system, it will be auto-imported into the current Metron database, and will be converted to a native Metron image. Further, it will be automatically filtered with "Detail 2" from the filter-set called "Canon".

Note: The only way that a foreign DICOM can be auto-imported into Metron's database is by use of a routing rule. If not matching routing rule is found, they will arrive in "pending" mode, and the Receive Images button will blink red to alert you.

Special Requirement when Installing on Windows 7

After installing Metron on a Windows 7 computer, there are a few more steps that need to be done to enable it for DICOM receive. These things occur automatically on Windows XP, but for Windows 7, which has a stricter security environment, these things must be done manually. This is a one-time operation, performed just once after installing Metron.

1) Look in folder C:/Epona/Diclis and you will see three files with "exe" extensions. They are called: launch_service.exe, metron_service.exe, and remove_service.exe. ***For each of these***, right-click on the file, and choose "Properties". In the properties panel that pops up, choose the "Compatibility" tab. As shown in figure 1 below, check the box labeled "Run this program as an administrator".

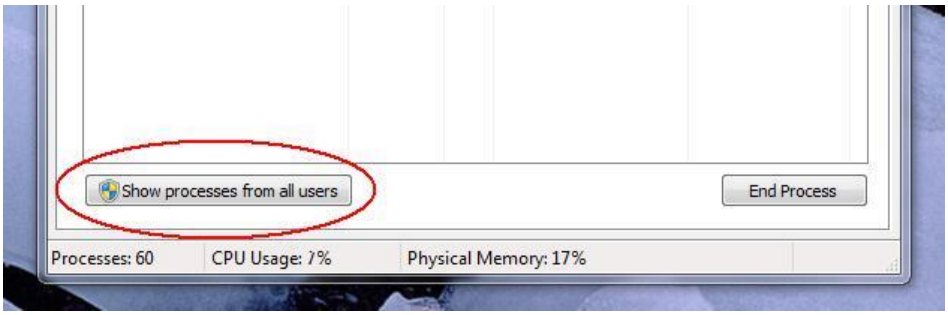

Launch_Service.exe Properties
General
Compatibility
Security
Details
Previous Versions
If you have problems with this program and it worked correctly on an earlier version of Windows, select the compatibility mode that matches that earlier version.
Help me choose the settings
Compatibility mode
Run this program in compatibility mode for:
Windows XP (Service Pack 3)
Settings
Run in 256 colors
Run in 640 x 480 screen resolution
Disable visual themes
Disable desktop composition
Disable display scaling on high DPI settings
Privilege Level
Run this program as an administrator
Change settings for all users
OK
Cancel
Apply

Set a program to "Run as Administrator". Repeat this for 3 programs in the C:/Epona/Diclis folder.

Make sure to enable this setting for all 3 of the programs, and click the "OK" button at the bottom of the panel each time.

2) Now double-click the program called "Launch_Metron.exe". This should start a process on the computer called "Metron_Service".

3) Now check with the Task Manager to see that there is a process called "Metron_Service" running. To get the Task Manager, do a CTRL-ALT-Delete and then choose the Task Manager. Choose the tab labeled "Processes". To check if "Metron_Service" is running, you may have to click on the choice to "show processes from all users". See screen capture below.



Click this button for a full listing of all running processes.

If you see "Metron-Service" is running, you are done, and Metron is ready to receive DICOM transmissions. If it is not running, something is wrong, so please check these instructions again.

If you shutdown the computer and re-boot, the "Metron_Service" process should be automatically started for you, so you should not have to perform any of these actions again.

The "Metron-Service" is the thing that "listens" for DICOM files that might be sent to Metron, so it needs to be running in order for DICOM Receive to function in Metron.

WARNING: Failure to perform these steps when installing on a Windows 7 computer will make Metron unable to receive DICOM files sent to it. Always verify that "Metron Service" is running in the background.

5. DICOM Modality Worklist

Modality Worklist allows Metron to query s remote DICOM server to fetch "worklists". That is, Metron can query a practice management system to ask "are there scheduled appointments requiring radiography?". This way, the patient information entered in the PM system can be transferred to Metron. In the "DICOM Preferences" Servers panel there is a setting where you indicate which server will be used to fetch worklists from. Then, on the Database Browser panel of Metron, a small button in the lower left labeled "W L" can be clicked to query that server.

Using the Worklist panel, the technician at Metron can see the schedule of upcoming exams. Any given exam can be used to create a new patient in Metron - thus avoiding re-entering of patient information in Metron.

6. DICOM Compliant CDs

DICOM compliant CDs and DVDs can be written by Metron. This function is found in the Database Browser panel and is labeled "Burn CD/DVD". To send a partial study, highlight the thumbnails of the images you wish to include before going into the Burn CD/DVD function. Adding of full studies can be done from within that panel.

These CDs contain the images in DICOM format as well as a viewer program (which resembles Metron itself) so that the CD you create may be sent to a recipient and they can view the images directly off the CD without the need for any particular software on their PC.

Alternate DICOM viewers can also view the images on the CD because the CD, in addition to the images, contains the required DICOMDIR file which some systems require.

7. Query/Retrieve from a Remote Server

Introduction

Metron supports the client side (or "SCU") of the DICOM Query/Retrieve capability. By this means, Metron can pull images from a DICOM PACs system back to Metron.

Configuring Systems for Q/R

The following steps must be taken to prepare for using Query/Retrieve:

1. Under "DICOM Preferences" create a server with the information given to you by the administrator of the PACs that you intend to retrieve images from.

2. Under "DICOM Preferences" you can choose which (of possibly several) servers you intend to use as your principle Q/R server. This simply will make it the default setting later when you enter the Q/R panel.

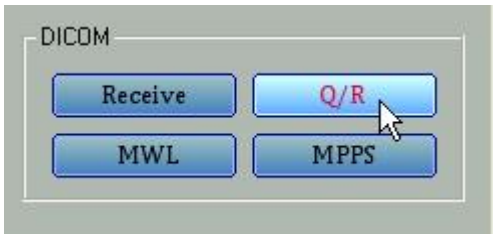
Choose your favorite Q/R server as the default.

3. The administrator of the remote server that you intend to query and retrieve from must be told the IP address, Port, and AE Title of your copy of Metron. The default values for the latter two are 4002 and METRON_AE. These can be altered, if need be, under "DICOM Preferences" under the "DICOM Receive" tab. If the remote server has not be configured to 'know' of your Metron, you may find that you can query, but not retrieve.

WARNING: Failure to make sure that the remote server has been set up to allow your queries and retrieves, will prevent retrieve from working. You must ask the administrator of the PACs system to enter your information into their server.

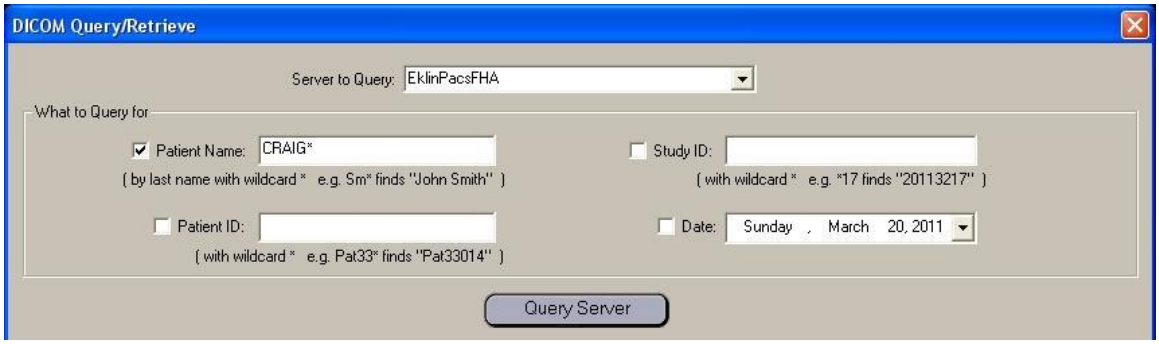
Using Query/Retrieve

Since the use of Q/R results in adding images to your system, it is located in the center section of the main Database Browser panel of Metron.



Click on the button labeled "Q/R…" (or in some layouts "DICOM Q/R…")

The top portion of the panel lets you select the server you wish to pull images from, and to describe the query you will use to hunt for images on that server.


DICOM Query/Retrieve
Server to Query: EklinPacsFHA
What to Query for
Patient Name: CRAIG*
(by last name with wildcard * e.g. Sm* finds "John Smith")
Study ID:
(with wildcard * e.g. *17 finds "20113217")
Patient ID:
(with wildcard * e.g. Pat33* finds "Pat33014")
Date: Sunday , March 20, 2011
Query Server

Check one or more of the query criteria and enter values (usually with "" for wildcard)*

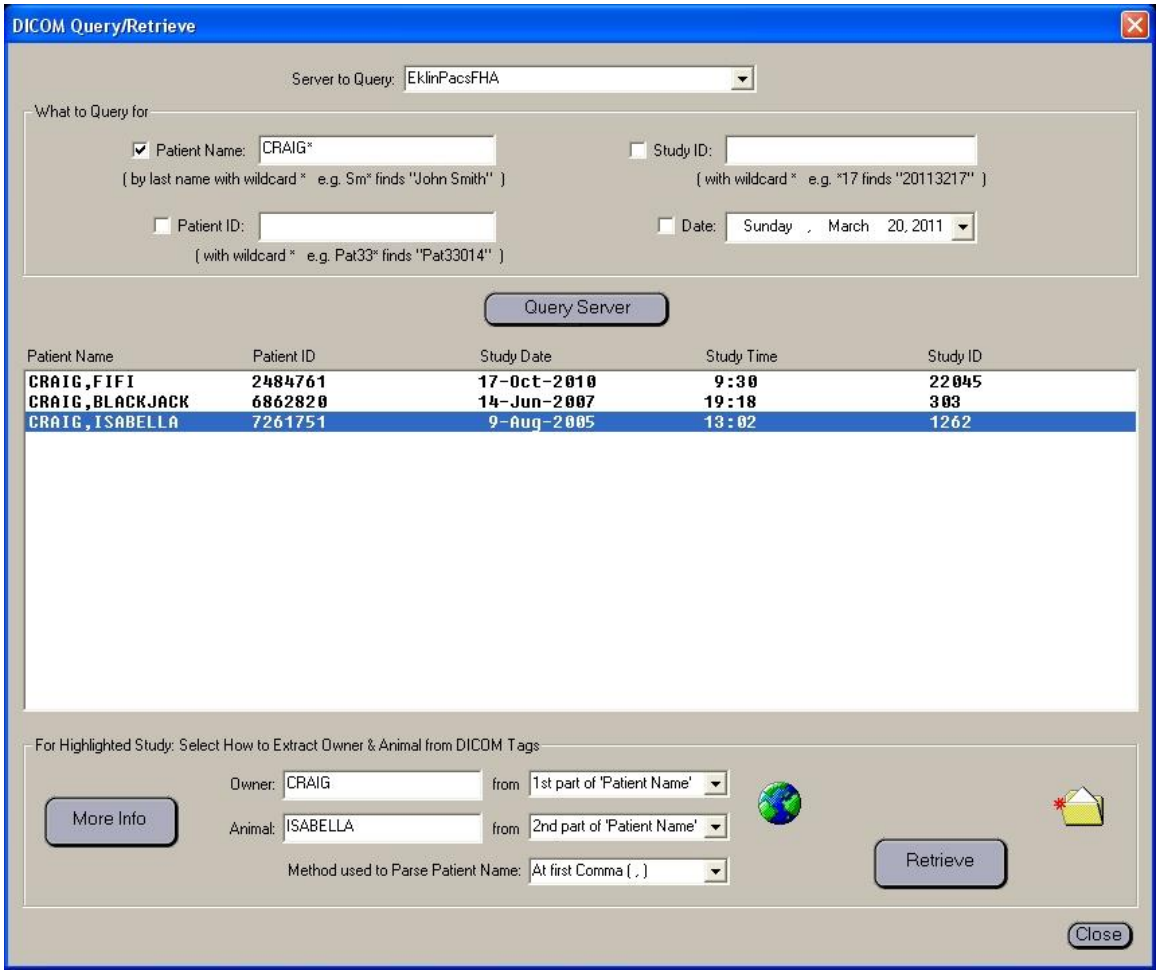
It is recommended to use the "*" character as a wild-card unless you know the exact value used on the remote system for patient name, or other criteria. You can query on one or more of:

1) Patient Name
2) Patient ID
3) Study ID
4) Date of the Study

After setting up your criteria, click on "Query Server". After a short delay a list of all studies on the remote system matching your criteria will be displayed. If you don't see what you are seeking, just alter your query keys, and click "Query Server"' again.

To retrieve one of the displayed studies back to your local Metron, click on that study to highlight its line in the list. At the bottom of the panel, you will see how Metron will extract the storage names from the DICOM tags. You can alter the source of these tags with the three associated pull-down menus to try to extract these names as you would like to see them in Metron.

Click the "Retrieve" button to commence the retrieval of the study images.

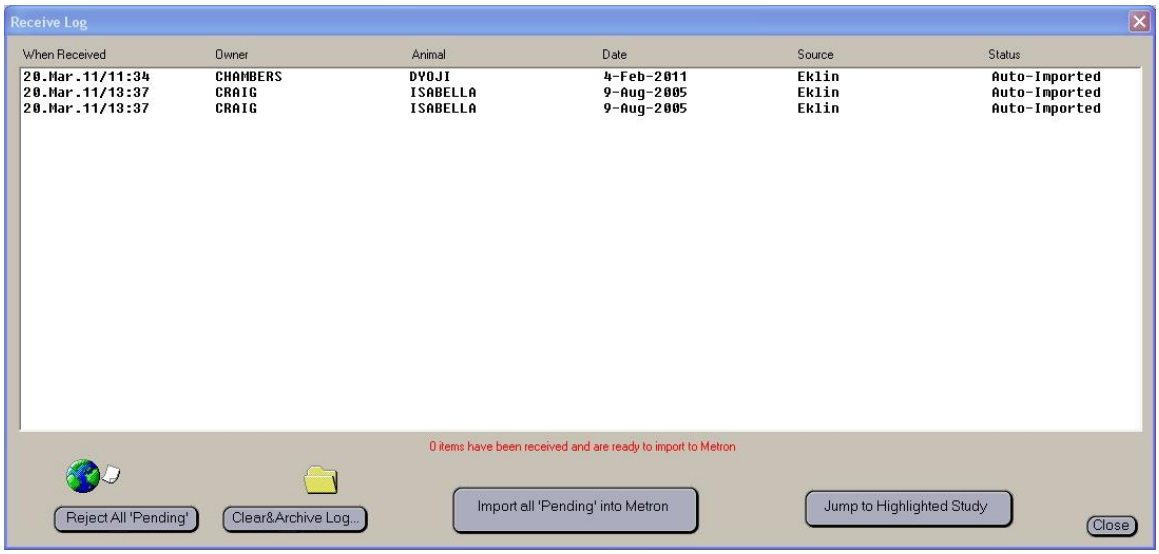

DICOM Query/Retrieve
Server to Query: EklinPacsFHA
What to Query for
Patient Name: CRAIG*
(by last name with wildcard * e.g. Sm* finds "John Smith")
Study ID:
(with wildcard * e.g. *17 finds "20113217")
Patient ID:
(with wildcard * e.g. Pat33* finds "Pat33014")
Date: Sunday , March 20, 2011
Query Server
Patient Name
Patient ID
Study Date
Study Time
Study ID
CRAIG,FIFI 2484761 17-Oct-2010 9:30 22045
CRAIG,BLACKJACK 6862820 14-Jun-2007 19:18 303
CRAIG,ISABELLA 7261751 9-Aug-2005 13:02 1262
For Highlighted Study: Select How to Extract Owner & Animal from DICOM Tags
More Info
Owner: CRAIG from 1st part of 'Patient Name'
Animal: ISABELLA from 2nd part of 'Patient Name'
Method used to Parse Patient Name: At first Comma (,)
Retrieve
Close

A study is selected, criteria for determining storage names selected, and retrieval is underway.

As soon as the retrieval has commenced, you are free to leave this panel and do other activities in Metron while the images are fetched. You can even exit Metron and they will still be fetched (of course, the computer must stay on and connected to the internet).

Metron's Q/R feature is "study based" – you query for a list of studies, and you may decide to retrieve a study. There is not a way to only retrieve a subset of the images in the study – it is always the full study that is retrieved.

At any time, you may click on the "Receive Images" button in Metron's main Database Browser panel to see the status of your retrieval operation.



The "Receive Images" panel shows a log of images that have come into Metron via DICOM, including those retrieved as part of a Q/R action.

If the retrieval animation is running, it means Metron is running the retrieval process in the background. New lines will appear in the log as images arrive at Metron. You can go look at them, and return to this panel later to again check progress.

Depending on the kind of remote server you are retrieving from, and how you have your copy of Metron configured, the retrieved images might show up as "Pending" (causing the "Receive Images" button to blink), or they might be "Auto-Imported" directly into your local Metron database (which does not cause the "Receive Images" button to blink, but does leave a line in the log seen in the Receive Images panel).

In the "DICOM Preferences" panel under the "DICOM Receive" tab, it may be possible for you to set up an auto-import rule for DICOM images arriving from a Q/R transfer.

Troubleshooting Query/Retrieve

1. I can Query but Retrieve does not return any images

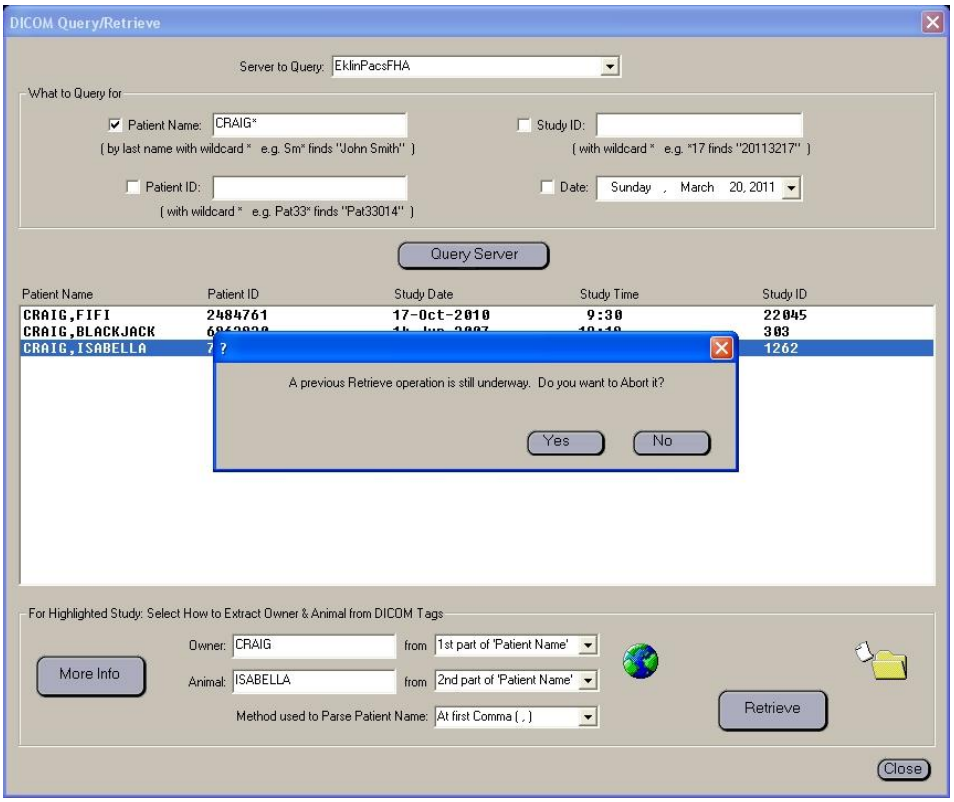
Most likely the remote server has not been set up to "know" about your Metron and so it is not allowing the unknown system to pull images from it. The administrator of the remote system has to set it up to "know" about your Metron. What they need is:

1) Your IP address (use www.ipchicken.com to get your IP address if you don't know it)
2) Your Port (Metron listens on port 4002 by default)
3) Your AE title (Metron is known as METRON_AE by default)

Note: if you don't have a "static IP address", your IP address may change from time to time without your knowledge. You can always check with www.ipchicken.com --- but of course it will be inconvenient to be continually having to ask the remote system's administrator to update your IP address in their server.

2. Retrieve gets stuck and never completes

You can stop an active retrieve operation in Metron by going back to the Q/R panel and clicking on the "Retrieve" button. It will tell you that a retrieve is underway, and will offer to let you stop it.


DICOM Query/Retrieve
Server to Query: EklinPacsFHA
What to Query for
Patient Name: CRAIG*
(by last name with wildcard * e.g. Sm* finds "John Smith")
Study ID:
(with wildcard * e.g. *17 finds "20113217")
Patient ID:
(with wildcard * e.g. Pat33* finds "Pat33014")
Date: Sunday , March 20, 2011
Query Server
Patient Name
Patient ID
Study Date
Study Time
Study ID
CRAIG,FIFI 2484761 17-Oct-2010 9:30 22045
CRAIG,BLACKJACK 303
CRAIG,ISABELLA 1262
A previous Retrieve operation is still underway. Do you want to Abort it?
Yes
No
For Highlighted Study: Select How to Extract Owner & Animal from DICOM Tags
More Info
Owner: CRAIG from 1st part of 'Patient Name'
Animal: ISABELLA from 2nd part of 'Patient Name'
Method used to Parse Patient Name: At first Comma (,)
Retrieve
Close

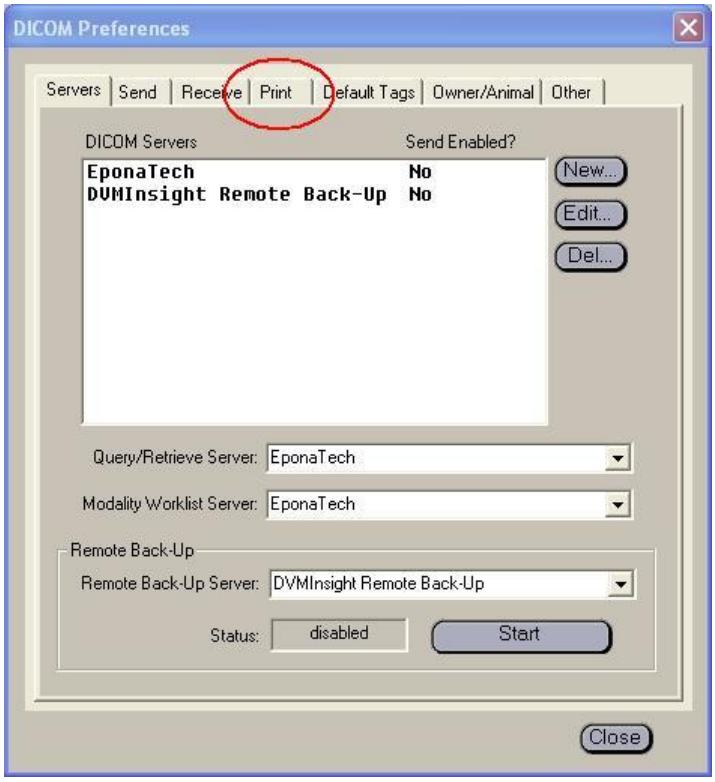
Click "Retrieve" while Metron is retrieving, and you can kill the retrieve.

8. DICOM Print

DICOM Print is supported as of release 6.07.

Configuring DICOM Print

In the DICOM Preferences panel there is a tab for DICOM Print:



Initially DICOM Print will not appear in Metron's user interface until it is turned on by checking the box at the top of the DICOM Print Preferences page:

You should then choose which DICOM Printer you will be using from the pull-down. These names refer to text files that specify the capabilities of a given printer. These files reside in C:/Epona/DP/Desc and if you open the one for Fuji-DryPix-1000 it's contents are:

[Fuji-DryPix-1000]
Aetitle = PRINTER_AE
Description = Fuji-DryPix-1000
Hostname = localhost
Port = 4008
Type = LOCALPRINTER

BorderDensity = 150\20\BLACK\WHITE
DisableNewVRs = false
DisplayFormat=1,1\1,2\2,2\2,3\3,3\3,4\3,5\4,4\4,5
EmptyImageDensity = 20\BLACK\WHITE
FilmDestination = MAGAZINE\PROCESSOR\BIN_1\BIN_2
FilmSizeID = 8INX10IN\10INX14IN
ImplicitOnly = false
MagnificationType = REPLICATE\BILINEAR\CUBIC\NONE
MaxDensity = 320
MaxPDU = 32768

MediumType = PAPER\CLEAR FILM\BLUE FILM
MinDensity = 20
OmitSOPClassUIDFromCreateResponse = false
PresentationLUTMatchRequired = false
PresentationLUTinFilmSession = false
ResolutionID = STANDARD\HIGH
SmoothingType = NONE
Supports12Bit = true
SupportsDecimateCrop = true
SupportsImageSize = true
SupportsPresentationLUT = true
SupportsTrim = true

Important! You must edit the lines in the first section of this file in order to give the AEtitle, the Hostname, and the Port of your actual DICOM Printer.

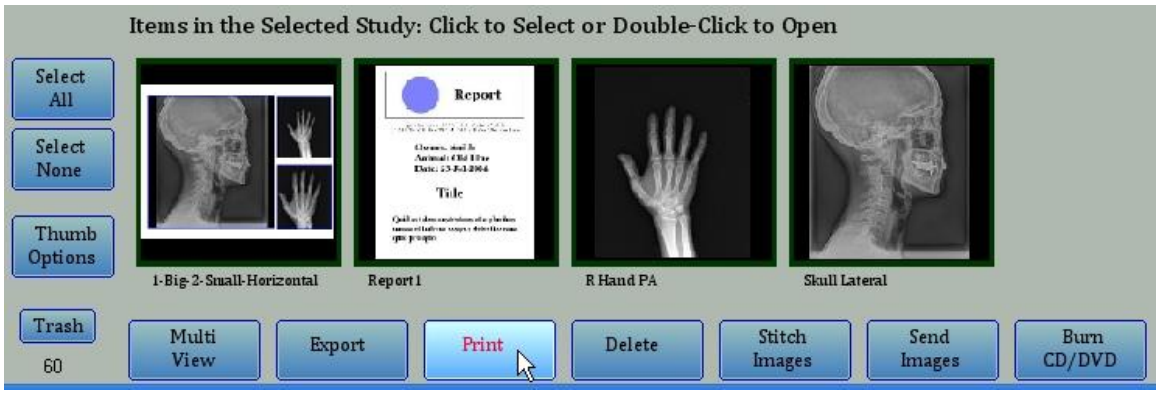
Other entries in this file may be edited if you think that it does not accurately describe this printer. Other files in this same format may be added to this folder to define other DICOM printers.

At present, the only selection under "Options" is the "Default" choice. In the future, we will have more flexibility by adding some optional inputs to the printing.

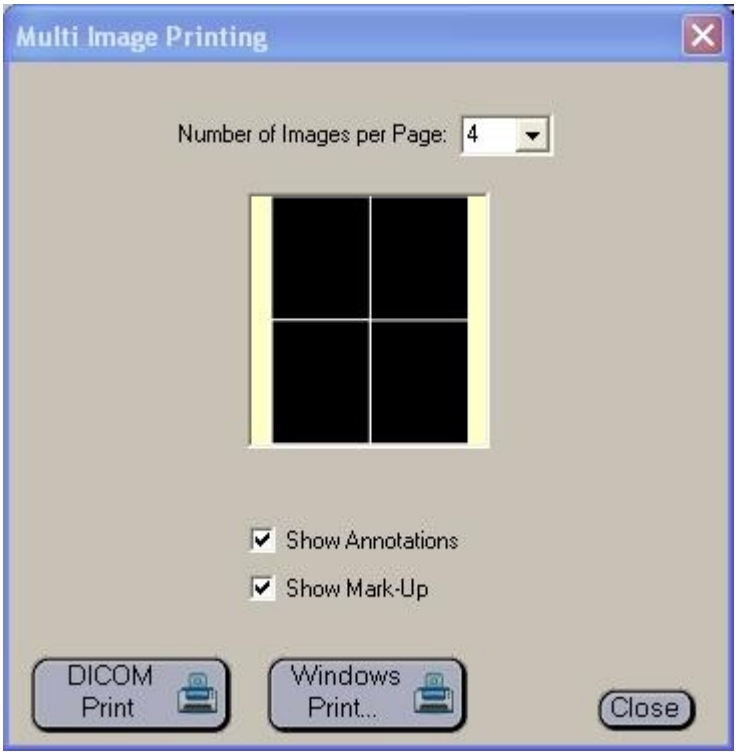
Using DICOM Print

DICOM Print is in the multi-image print interface familiar to Metron users.

First highlight the thumbnails corresponding to the images you wish to print (remember the "All" button is helpful if printing all images of a study). Then click the "Print" button at the bottom of the Study List screen:



Choose the number of images you wish to print per page. Indicate if you want Annotation and/or Mark-up to be shown on the images. Then click “DICOM Print”.



The printing will be sent to the printer.

Problems

If the images do not print, please send us the log file at:

C:/Epona/DP/LOG.TXT

Appendix B: Setting up Automatic Image Rotations

For most DR systems and some CR systems that Metron supports, there is a way to assign a rotation to the image when it is acquired. For small-animal systems, usually the animal is viewed across the screen, but for DV and VD shots, it is customary to have the body oriented up-and-down on the screen. For this and other reasons, we need a way to rotate images in an automatic fashion depending on the anatomy and the view taken. For equine systems, the required view rotations can become elaborate.

The "<Platform>ViewRotations.txt" File

Here is how to assign automatic image rotations. It is done in a file which sits in:

C:/Epona/Databases/Main

and the file is called (depending on the system) one of these:

SamsungViewRotations.txt
RpanelViewRotations.txt

or maybe another name. Please ask EponaTech if you can't find the file name for your hardware.

Here is an example of the contents of the "<Platform>ViewRotations.txt" file for an equine system:

VERSION = 1.0
Default =-90
*,DP,RF,90
*,DP,RR,90
*,Lateral,LF,90
*,Lateral,LR,90
Head,*,*,0

The idea is this: in the second line I give the "Default Rotation" which is applied to all images unless the default is overridden in a following line in the file. So, the current default is -90. To understand it you have to know where "zero" is.

Each line of the file can specify the rotation to use instead of the default for a given Region, View, and Limb.

For example, if you put in the line

Foot,Lateral,RF,90

it would use a 90-degree rotation for the Right Front lateral of the Foot.

Then, Metron is set it up so that "*" (asterisk) is the "wild card". So in the current file, the line

*,DP,RF,90

Means that the DP view of ANY region for the RF will be 90. So, this works for Foot, Pastern, Fetlock, Cannon -- in fact every shot that has a view called "DP".

You see later in the file I have

Head,*,*,0

Meaning that any view of the head, I think we want an image wider than tall, so we use rotation = 0 (which happens to be the correct number for one certain panel – it may not be for yours)

The only values of rotation you can give are 0,90,-90,180

You have to use "RR" and "LR" for hind limbs (not "RH" and "LH")

Finally, you want to keep this list (the number of lines in the file) as short as possible - simplicity is good - the system searches down this list after each shot to check if the shot should be rotated or not, so its best if the list is not hundreds of lines long.

(Note: if you look at the default values in "SamsungViewRotations.txt" (which is for equine) you will see a rather complete example of 'good settings' for an equine system).

DENTAL

Similar files exist for DR Dental systems, e.g. "DRDentalViewRotations.Accent.txt"

They are essentially only used for flipping the image by 180 depending if in the "Right" side or the "Left" side of the mouth.

Appendix C: Image Stitching in Metron-MD

Image stitching is available in Metron-MD so that two or more images can be joined together into a single image. This is a purely manual process and it is up to the Metron user to align images and then to store the stitched image.

First the Metron user must take two or more images that are nearly equally exposed and that are suitable for stitching. In this example, we use an image of a hand and forearm (Figure 1), along with a second image of the forearm and elbow (Figure 2).

Figure 1. First image.

Figure 2: Second image.

The original images have been acquired and are in the same study in Metron (Figure 3).

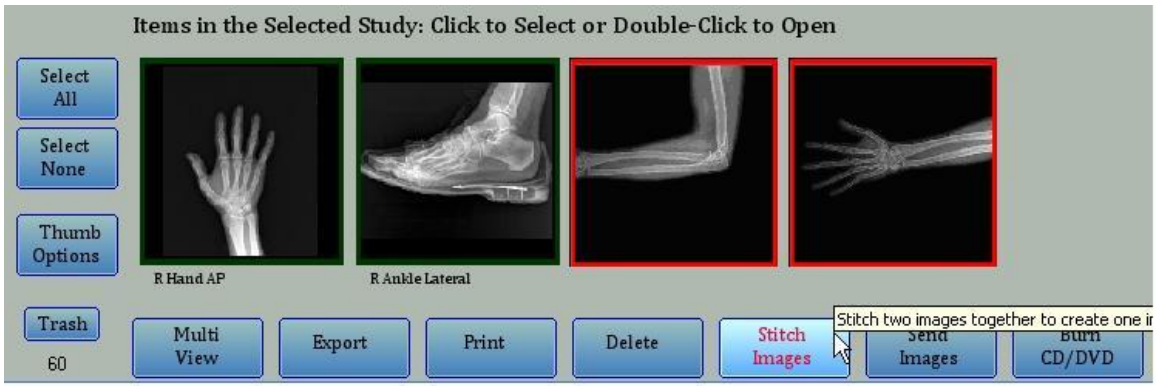


Figure 3: Two images, suitable for stitching, in the same study in Metron-MD

The user begins by selecting two (or more) images by clicking to highlight them, and then clicks on the "Stitch Images" button (Figure 4).

A new “Stitch Images” panel is presented (Figure 4). The “Stitch Images” panel has several controls on the right hand side which allow the user to drag and position images, rotate them, scale them, trim them, etc.

Figure 4: The “Stitch Images” panel.

The user begins by clicking on an image and dragging it with the mouse. The “palette” enlarges as needed as images are dragged on the screen. In Figure 5 a rough initial positioning has been done by just dragging the image of the hand.

Figure 5: User has dragged the image of the hand to the left side of the area.

In this example, the user now sees that the left image (hand and forearm) must be rotated slightly in the clockwise direction. Since this image is highlighted in red, it is the "active image" which the tools on the right hand side of the panel will control. So, the "Fine Rotation" buttons are used to rotate this image as shown in Figure 6.

Figure 6: The user has rotated the left hand image (hand and forearm) into alignment with the forearm portion of the second image. This rotation can be further tuned when the images are slid together.

The user drags the left image on top of the right hand image, and uses the "Fine Jog" buttons in the panel to carefully position it into alignment (Figure 7). Other options available to the user were not required in the case of these two images (options such as "scale" to enlarge one image relative to other, trim options to trim edges, push/pop to control which image is "on top", etc).

Figure 7: The user uses the "Fine Jog" buttons (red colored arrows) to carefully jog the image into position.

Figure 8: The red highlight box around the "active image" can be temporarily turned off so the user can see exactly how the stitch will look.

Satisfied with the alignment of the images, the user clicks the button labeled "Stitch Done, Add to Study", and the stitched image is added to the study (Figure 9). The original two images are not disturbed.

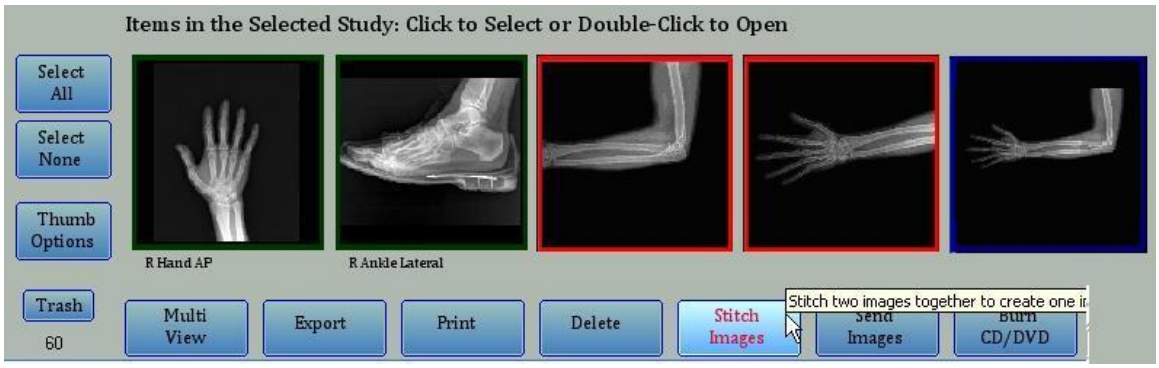


Figure 9: Stitch is complete. This image may now be used in Metron just like any other image.

The final stitched image is shown in Figure 10.

Figure 10. The final, stitched image. The stitch line is apparent because the two X-Ray exposures were not the same in this exam.

Appendix D: Guided Mark-Up in Metron-MD

Example: Measurements for the Lateral Radiograph of the Lumbar Spine

Guided Mark-Up is provided for certain radiographic views for which current practice has well defined measurements. The guided mark-up process prompts the user to pick key points in the image from which these measures are computed.

The guided mark-up process will be illustrated by the example of measurements for the lateral radiograph of the lumbar spine as shown in Figure 1.

Figure 1. Lateral Lumbar Spine Radiograph

The process starts by acquiring the image, labeling the anatomy by selecting the appropriate region on the anatomy chart, and clicking the "Guided Mark-Up" button (Figure 2).

Figure 2. Select the "Guided Mark-Up" Tool

A new panel for the “Guided Mark-Up” process (the “Guide Panel”) is presented on the right side of the screen (Figure 3), where instructions are presented. The user works on the actual radiograph on the left side of the screen, picking points etc., following the instructions on the Guide Panel.

Figure 3. Screen shot after the Guided Markup button is pressed.

On the Guide Panel (Figure 4), step-by-step instructions that instruct the user which points to pick in the radiograph are shown near the top of the window. Here, the user is instructed to pick 2 points on the posterior body of each vertebra from L5 to T12.

An Instructional Image is displayed at the center of the Guide Panel. There are red boxes on the Instructional Image that indicate where the user should pick the points on the actual radiograph. The Instructional Image is NOT the actual radiograph in question. Rather, it is a fixed "sample radiograph" just used as part of the instructions to show where to pick the points. There is a new Instructional Image for each step of the process showing which points to pick in that step.

Note that if anything is obscured or difficult to pick during any step of this process, the user may indicate this fact by selecting the box labeled "Feature unclear, and "These picks are guesses,"" which box is near the bottom of the Guide Panel. If this selection is made, the procedure continues, but the measurements resulting from these picks will be highlighted in a blue font so that the user is reminded that they may not be fully accurate.

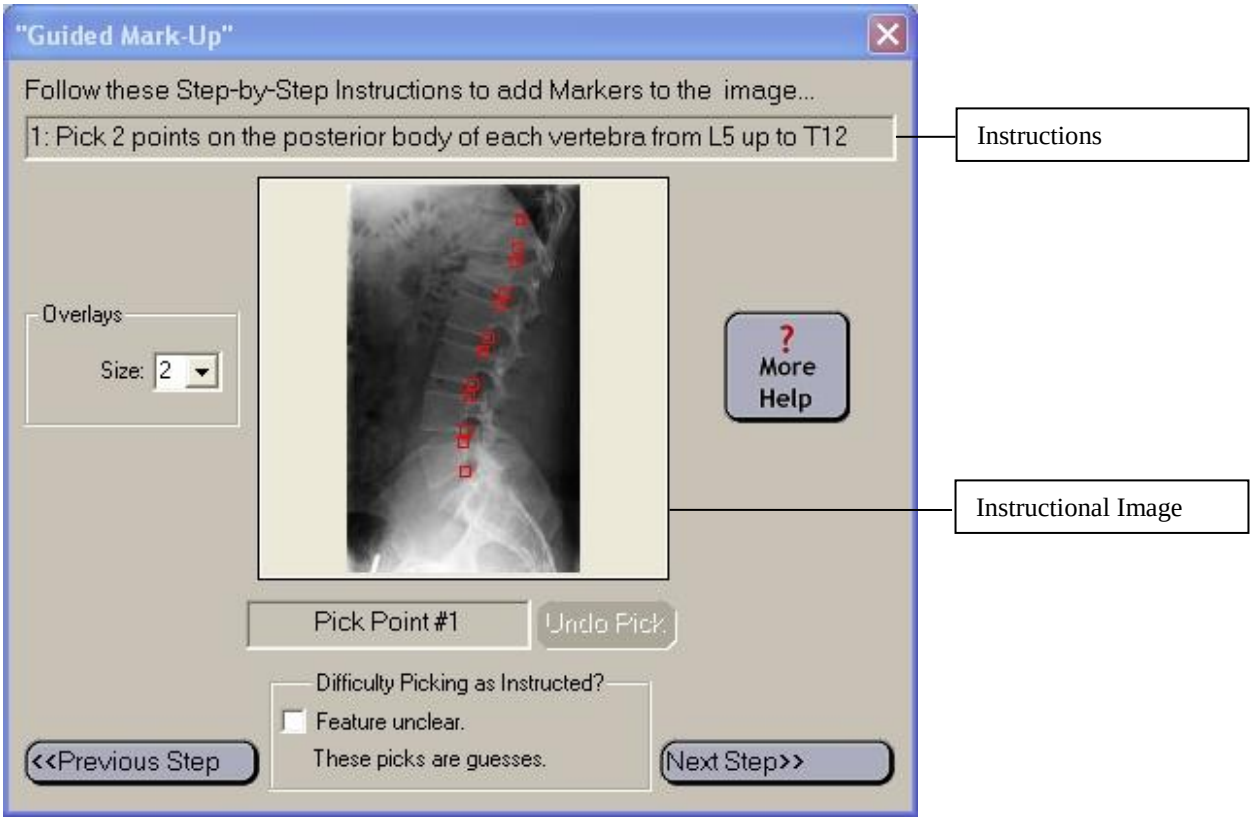


Figure 4. Guide Panel for Step 1

The user uses his medical judgment to pick the actual points in the actual image on the left side of the screen (Figure 5). As the user picks the points, small red squares are overlaid on the image to show the points that have been picked. These selected points may be "dragged" with the mouse so that the user can be sure to position them where he wishes.

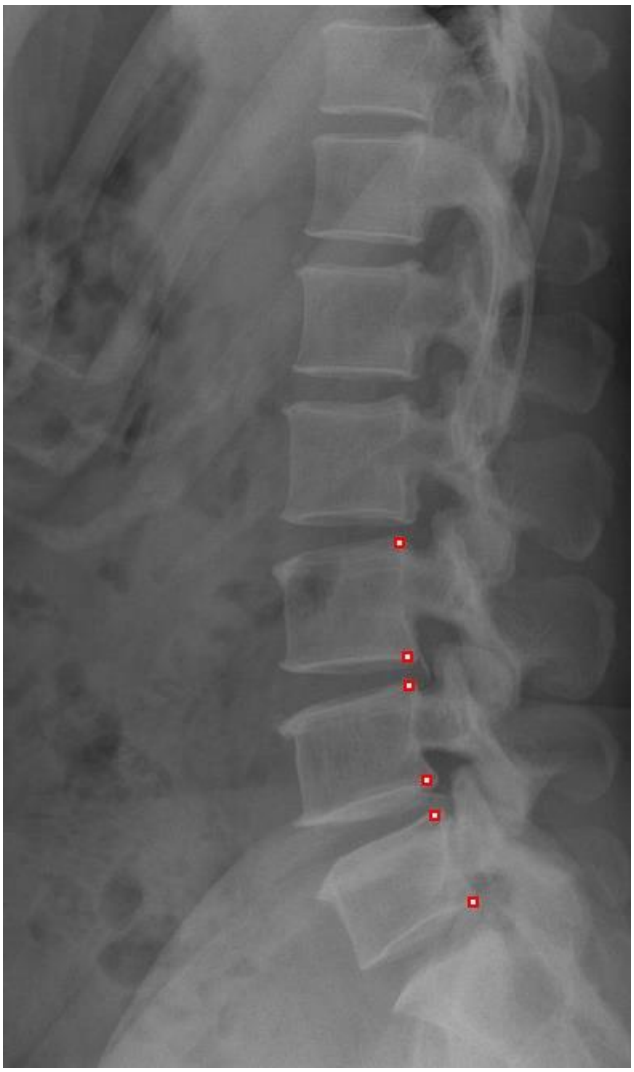


Figure 5. Step 1 of the lumbar spine picking mark-up in progress. This image shows this task after the user has selected 6 points.

When the requested number of points have been picked by the user, a green curve is displayed that is constructed from these points (Figure 6). In guided mark-up, the appearance of green overlaid graphics always indicates that the picks are complete for the current instruction step.

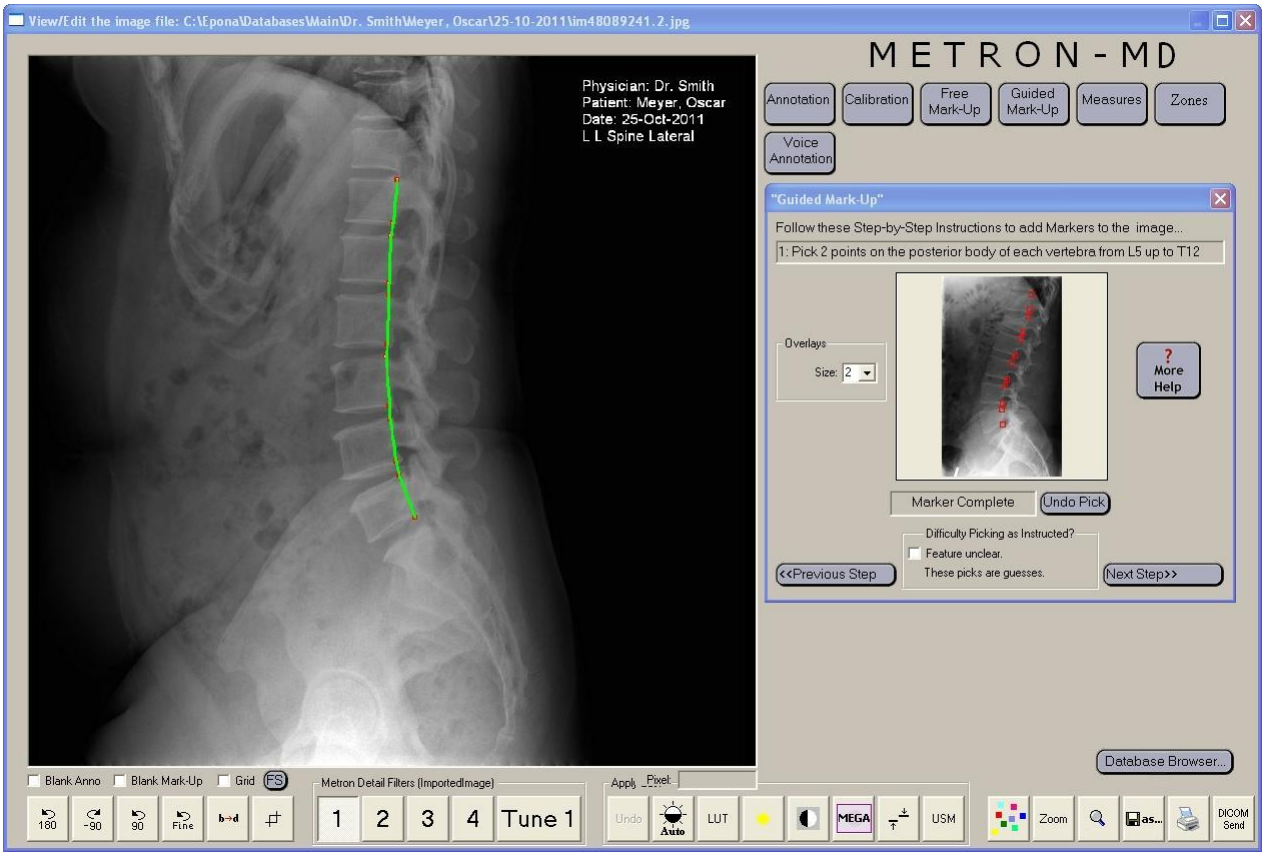


Figure 6. The picks for "Step 1" of the guided mark-up have been completed.

The user then clicks on the “Next Step>>” button in the Guide Panel to advance to the next step, Step 2, and the user is instructed to select the two “superior” points on S1, the Sacrum. (Figure 7). When the user has picked the two points on the sacrum in the actual radiograph, a green line is drawn on the radiograph, which signals the user that he has completed this step (Figure 8).

Figure 7. Guide Panel for Step 2, pick two superior points on S1.

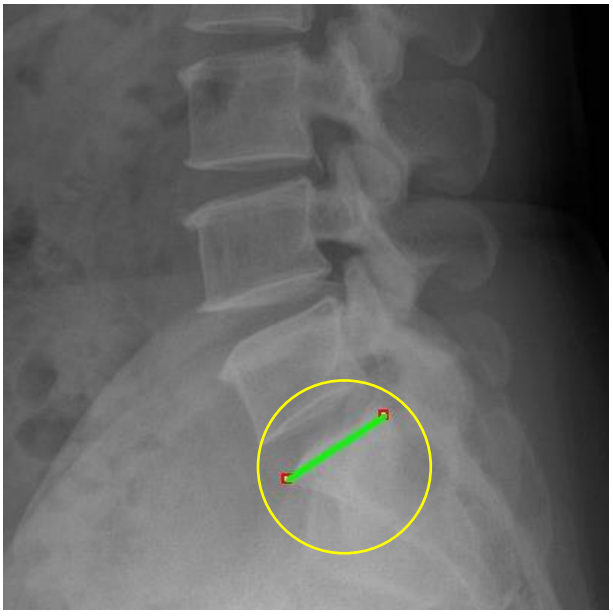


Figure 8. Step 2 is completed.

Again, when the user clicks on "Next Step>>," the process advances to Step 3, and the user is instructed to pick the "anterior inferior" point on the L5 (Figure 9). Since this step of the instructions calls for just a single point being picked, it is immediately highlighted in green after the user has selected the point on the radiograph, indicating that the user has completed this step (Figure 10).

Figure 9. Guide Panel for Step 3, pick anterior inferior point on L5.

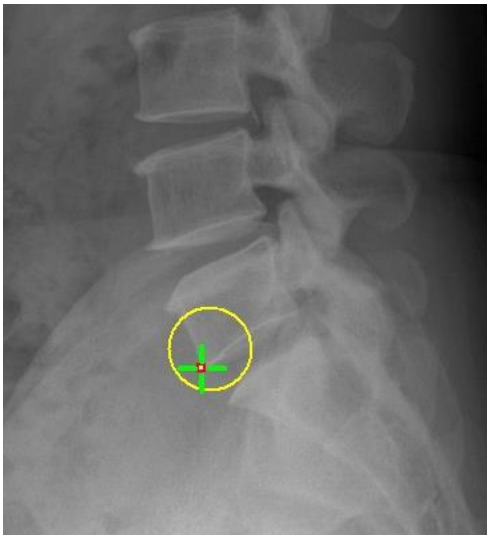


Figure 10. The user has selected the requested point.

In the next step, Step 4, the user is instructed to pick 2 points on the anterior body of L3 (Figure 11).

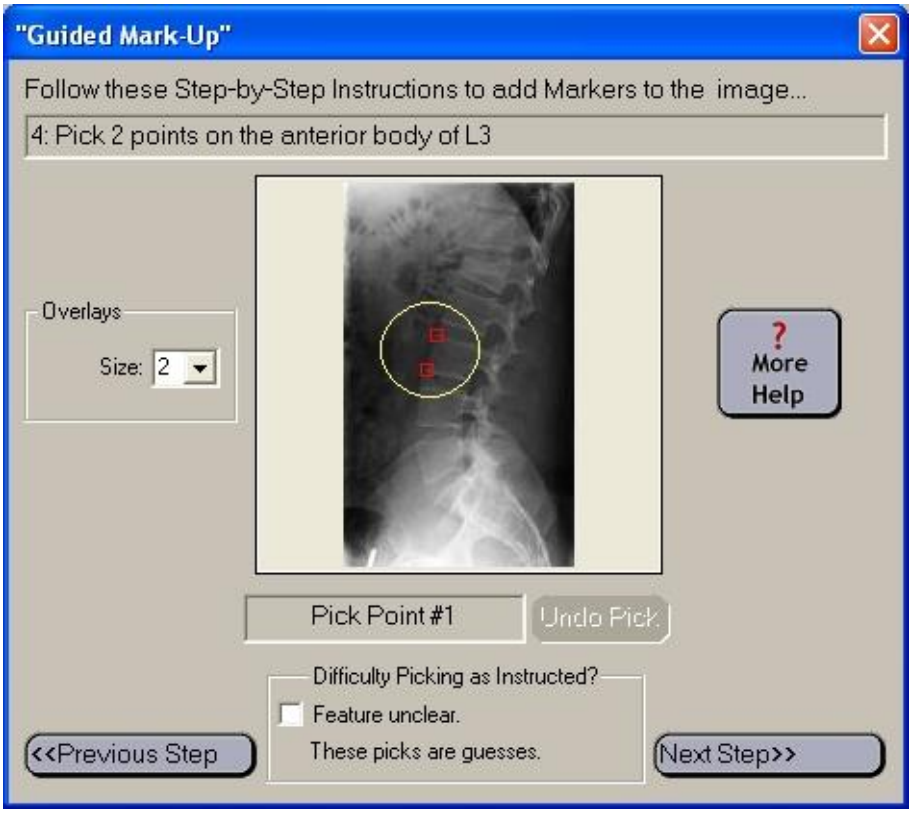


Figure 11. Guide Panel for Step 4, pick 2 points on the anterior body of L3.

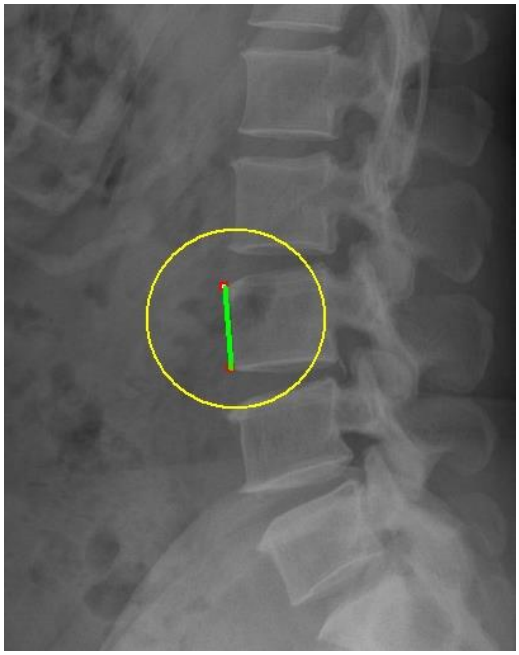


Figure 12. After the user selects the two points on the radiograph, a green line is drawn between them to indicate that the requested picks are complete.

When the user clicks on "Next Step>>," the Guide Panel for Step 5 is presented, which is the last step in the guided mark-up of the lateral lumbar spine. The user is instructed to pick the two points on the anterior of the T12 vertebra (Figure 13). When the user has selected the two points on the radiograph, a green line is drawn to indicate that this step of the process is complete (Figure 14).

Figure 13. Step 5, pick 2 points on the anterior body of T12

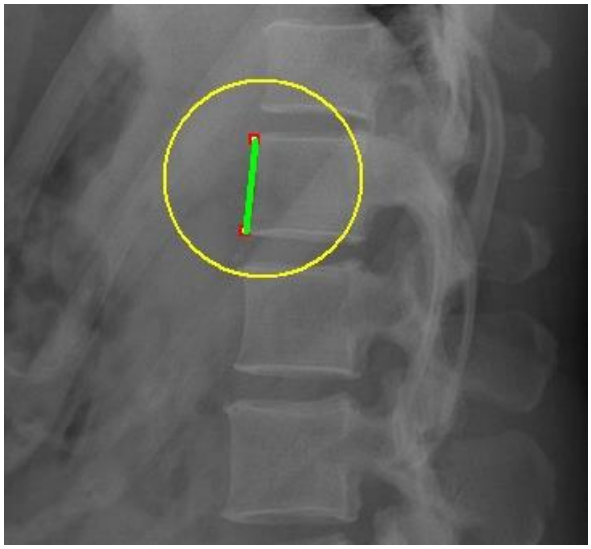


Figure 14. Step 5 is complete.

When the final points have been picked in the guided mark-up process, clicking the Next Step button leads the user to a table of measurements that is made from these picks (Figure 15). The small check-box to the left of each measurement name can be selected to display the measurement overlaid on the image, so that the meaning of the measure will be clear to the user.

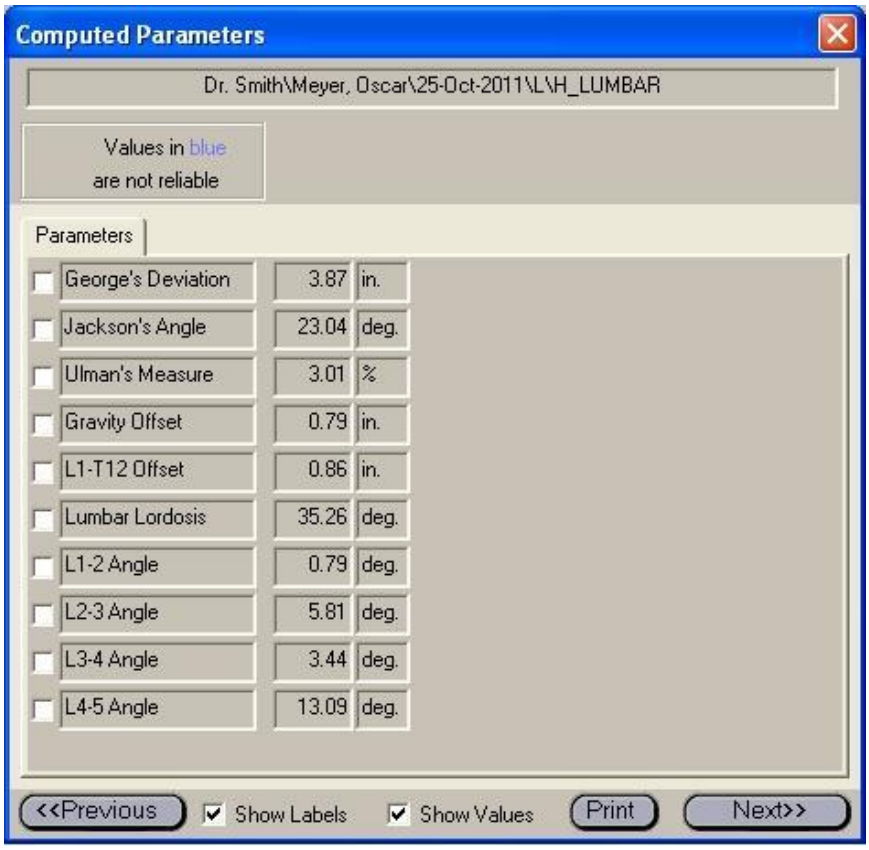


Figure 15: A table of computed measures. Clicking the check-box to the left of the measure's name will display it graphically on the image.

The Jackson's Angle measurement is displayed when the user checks the checkbox next to "Jackson's Angle" (Figure 16).

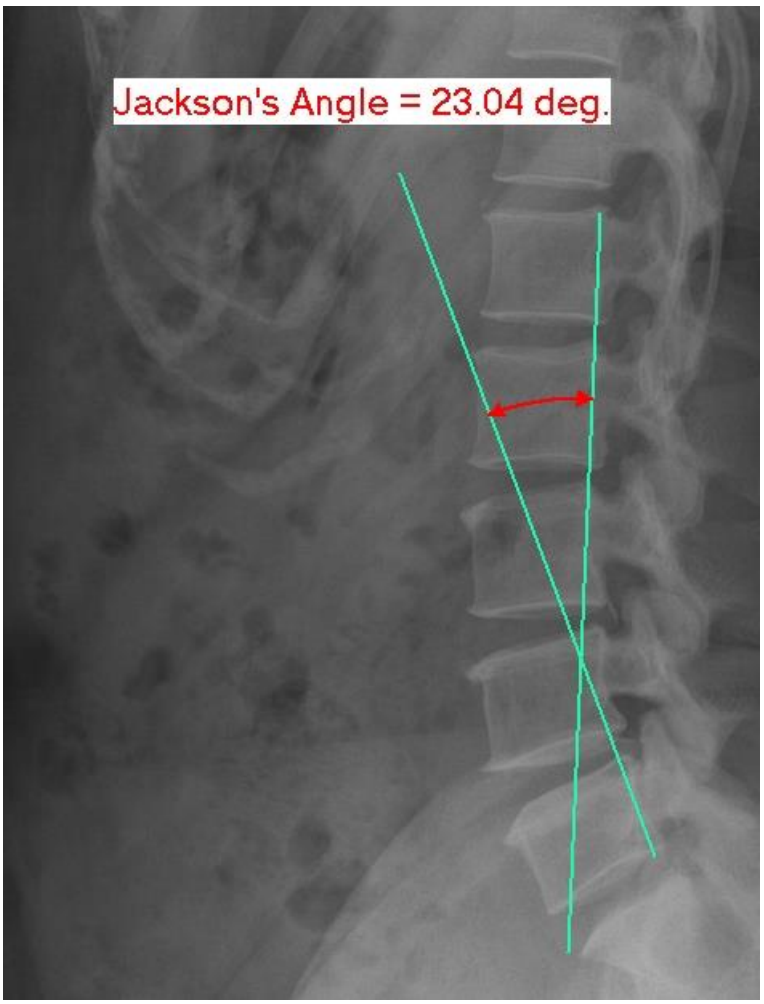


Figure 16. Example showing "Jackson's Angle" displayed on the image. This is a well known measure which is the angle between lines constructed from the posterior sides of the L5 and L1 vertebrae.

The Lumbar Dordosis measurement is displayed when the checkbox next to “Lumbar Lordosis” is checked (Figure 17).

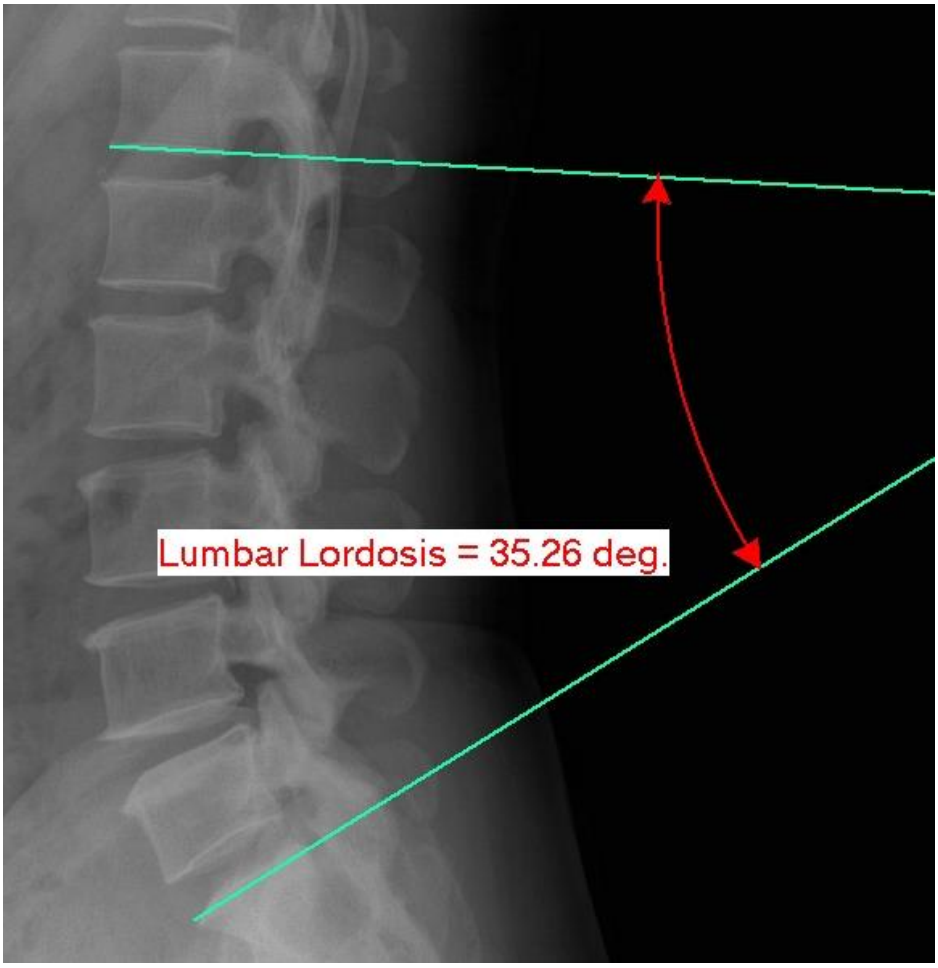


Figure 17. This example shows the lumbar lordosis overlaid on the image. It is an angle related to the top of the sacrum and the bottom of the T12 vertebra.

A user may check multiple checkboxes and have multiple measurements overlaid on the radiograph. Figure 18 shows the radiograph when the checkboxes for L1-2 Angle, L2-3 Angle, L3-4 Angle, and L4-5 Angle are checked.

Note that the guided mark-up process gives the practitioner a guide to pick certain key anatomy points in order to compute well-known measures. It is merely the presentation of simple picking instructions to the user so that these measures can be made in a standard way. The guided mark-up process itself is objective – no judgments are made regarding what these values "should be" in a healthy, normal individual.

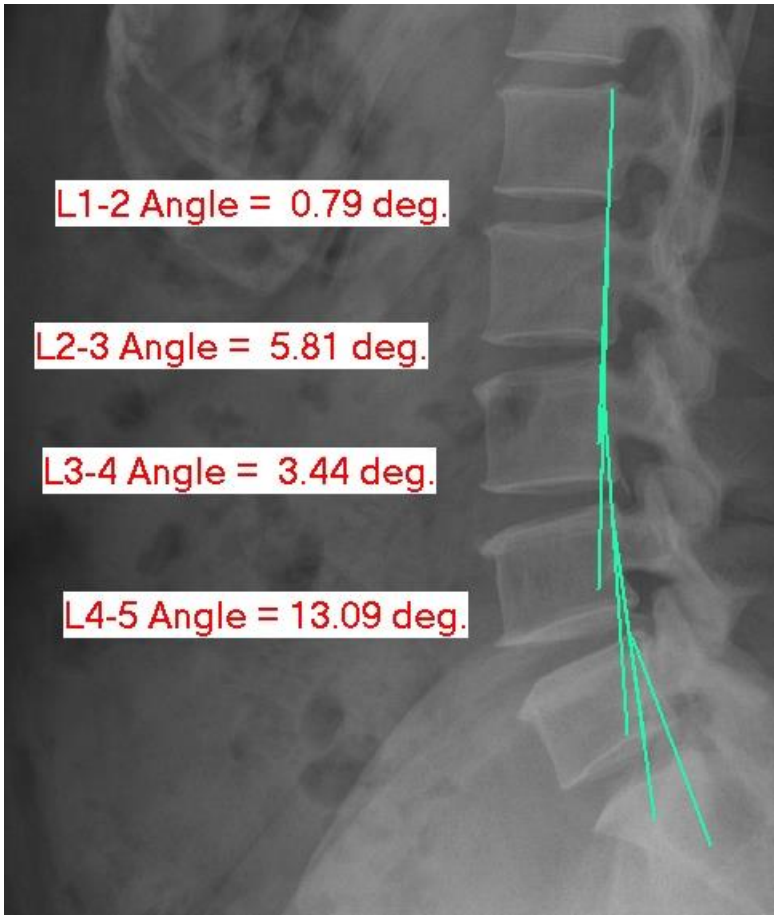


Figure 18. In this image, four of the check-boxes have been checked so that the relative angles between these vertebrae are all displayed on the image.

Metron does offer the ability for the physician to enter a set of "zones" which describes desirable ranges for each of these measured parameters. These ranges are entered by the physician if they wish to use this feature. While the measurements made by guided mark-up are standard and known to medical practitioners (in this case, chiropractors), there is not always agreement on what the "normal and healthy" values should be. Because of this disagreement among practitioners, Metron does not prescribe these "normal ranges" but gives the physician the ability to enter the ranges that they believe in. In Figure 19 we show the zones panel for a set of desirable ranges entered by the physician user of Metron.

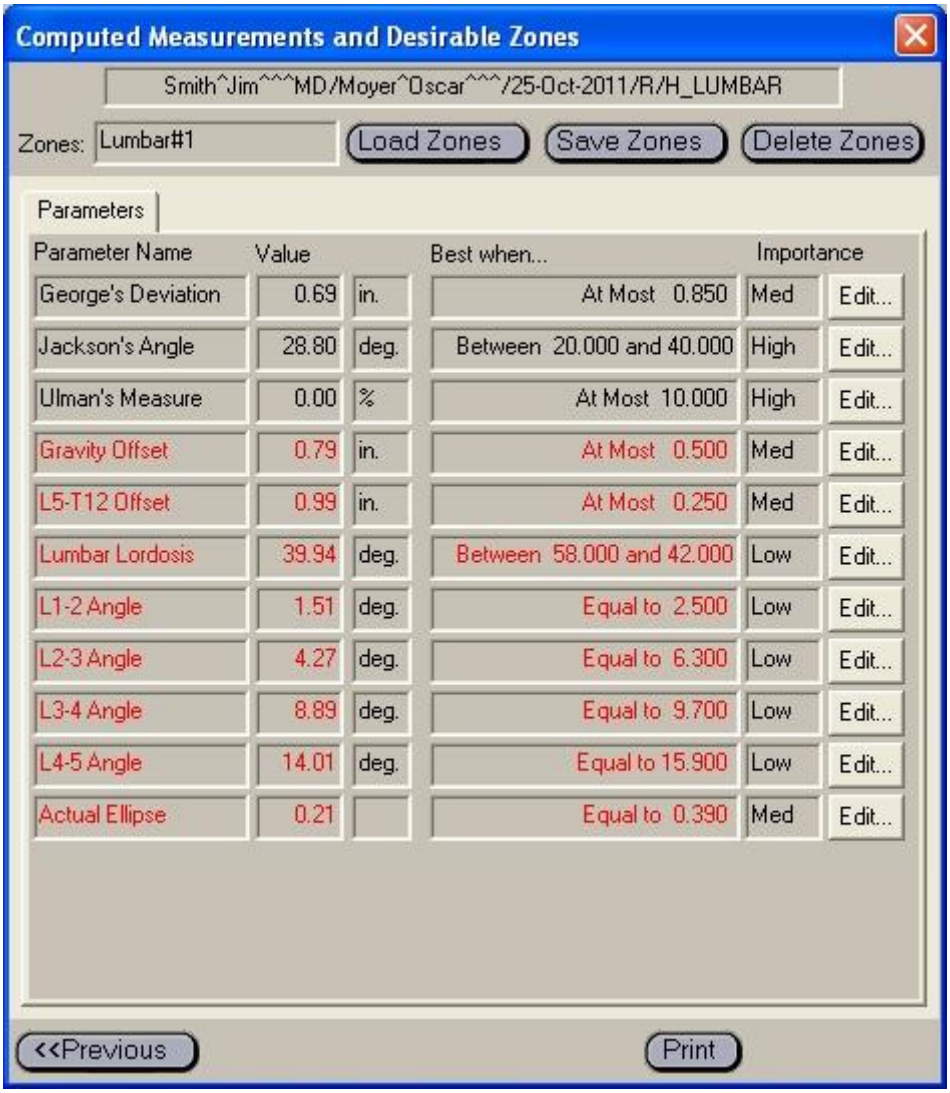

Computed Measurements and Desirable Zones
Smith^Jim^^^MD/Moyer^Oscar^^^/25-Oct-2011/R/H_LUMBAR
Zones: Lumbar#1
Load Zones
Save Zones
Delete Zones
Parameters
Parameter Name | Value | | Best when... | Importance
George's Deviation | 0.69 | in. | At Most 0.850 | Med | Edit...
Jackson's Angle | 28.80 | deg. | Between 20.000 and 40.000 | High | Edit...
Ulman's Measure | 0.00 | % | At Most 10.000 | High | Edit...
Gravity Offset | 0.79 | in. | At Most 0.500 | Med | Edit...
L5-T12 Offset | 0.99 | in. | At Most 0.250 | Med | Edit...
Lumbar Lordosis | 39.94 | deg. | Between 58.000 and 42.000 | Low | Edit...
L1-2 Angle | 1.51 | deg. | Equal to 2.500 | Low | Edit...
L2-3 Angle | 4.27 | deg. | Equal to 6.300 | Low | Edit...
L3-4 Angle | 8.89 | deg. | Equal to 9.700 | Low | Edit...
L4-5 Angle | 14.01 | deg. | Equal to 15.900 | Low | Edit...
Actual Ellipse | 0.21 | | Equal to 0.390 | Med | Edit...
<<Previous
Print

Figure 19. Once the user has entered desirable ranges and saved them as a set of "zones", Metron will display each parameter alongside its desirable range, and this line will be highlighted in red if the value (from the current image) falls outside this range.

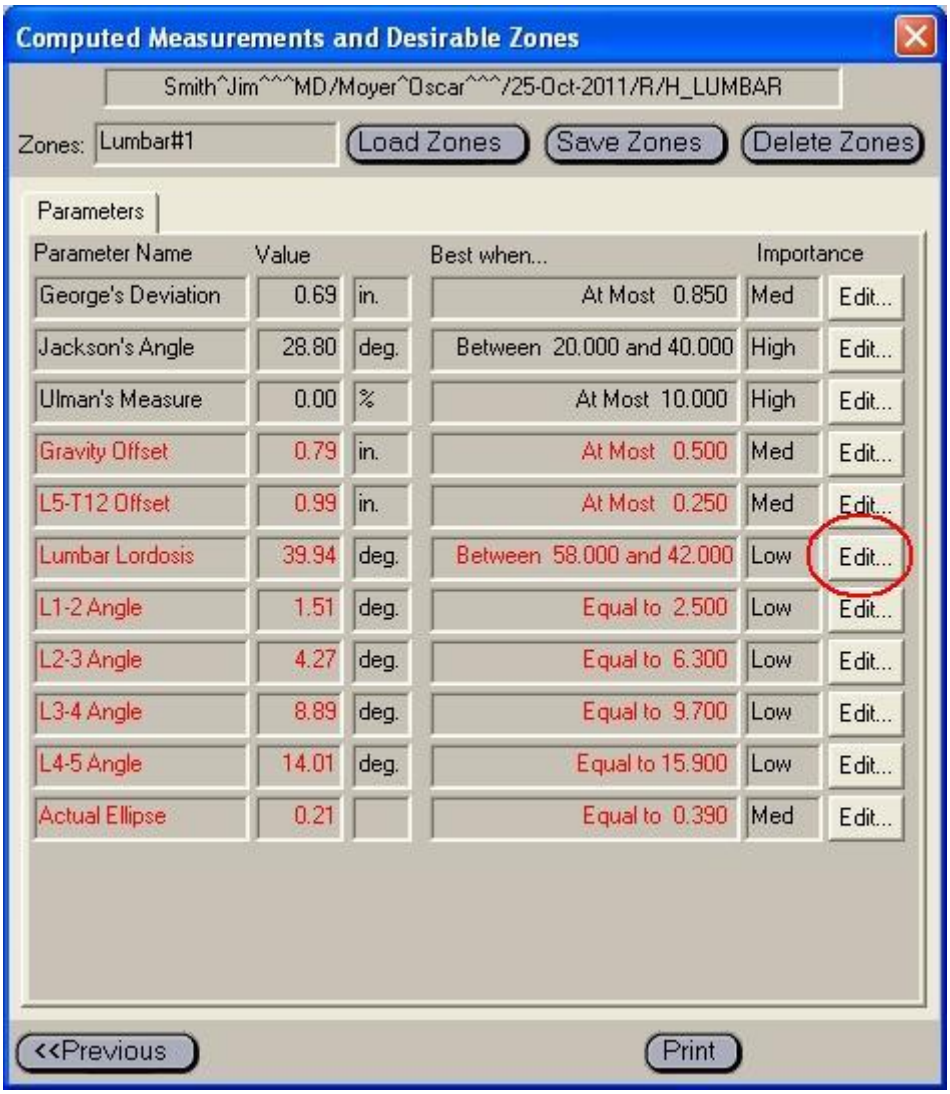

Computed Measurements and Desirable Zones
Smith^Jim^^^MD/Moyer^Oscar^^^/25-Oct-2011/R/H_LUMBAR
Zones: Lumbar#1
Load Zones
Save Zones
Delete Zones
Parameters
Parameter Name
Value
Best when...
Importance
George's Deviation 0.69 in. At Most 0.850 Med Edit...
Jackson's Angle 28.80 deg. Between 20.000 and 40.000 High Edit...
Ulman's Measure 0.00 % At Most 10.000 High Edit...
Gravity Offset 0.79 in. At Most 0.500 Med Edit...
L5-T12 Offset 0.99 in. At Most 0.250 Med Edit...
Lumbar Lordosis 39.94 deg. Between 58.000 and 42.000 Low Edit...
L1-2 Angle 1.51 deg. Equal to 2.500 Low Edit...
L2-3 Angle 4.27 deg. Equal to 6.300 Low Edit...
L3-4 Angle 8.89 deg. Equal to 9.700 Low Edit...
L4-5 Angle 14.01 deg. Equal to 15.900 Low Edit...
Actual Ellipse 0.21 Equal to 0.390 Med Edit...
<<Previous
Print

Figure 20. The "Edit" button next to each parameter can be used to edit the "desirable range" used in the set of zones. The user may also assign an "importance" as Low, Medium, or High, to each measure. These importance values are not used in any computation, but merely as notes to the practitioner.

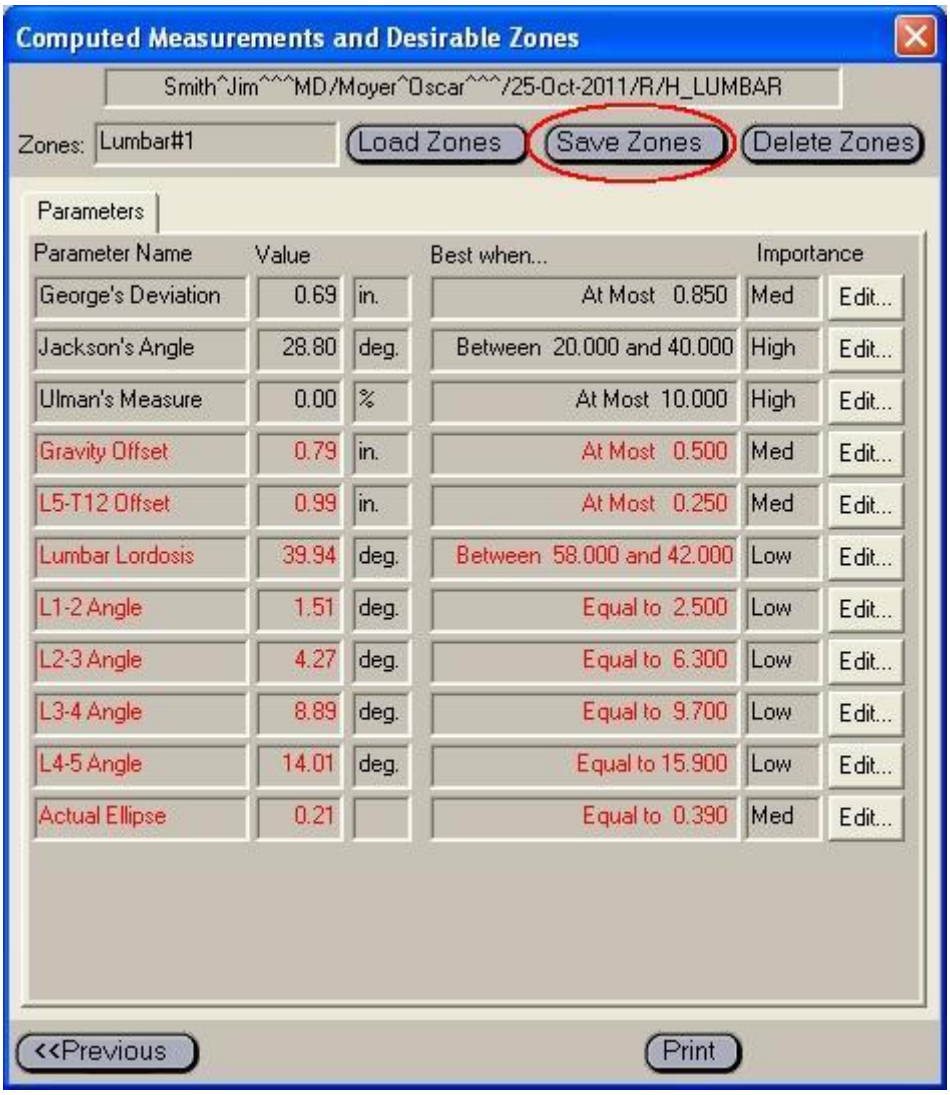

Computed Measurements and Desirable Zones
Smith^Jim^^^MD/Moyer^Oscar^^^/25-Oct-2011/R/H_LUMBAR
Zones: Lumbar#1
Load Zones
Save Zones
Delete Zones
Parameters
Parameter Name
Value
Best when...
Importance
George's Deviation 0.69 in. At Most 0.850 Med Edit...
Jackson's Angle 28.80 deg. Between 20.000 and 40.000 High Edit...
Ulman's Measure 0.00 % At Most 10.000 High Edit...
Gravity Offset 0.79 in. At Most 0.500 Med Edit...
L5-T12 Offset 0.99 in. At Most 0.250 Med Edit...
Lumbar Lordosis 39.94 deg. Between 58.000 and 42.000 Low Edit...
L1-2 Angle 1.51 deg. Equal to 2.500 Low Edit...
L2-3 Angle 4.27 deg. Equal to 6.300 Low Edit...
L3-4 Angle 8.89 deg. Equal to 9.700 Low Edit...
L4-5 Angle 14.01 deg. Equal to 15.900 Low Edit...
Actual Ellipse 0.21 Equal to 0.390 Med Edit...
<<Previous
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Figure 21. If a user edits the desirable ranges for one or more measures, the "Save Zones" button may then be used to save this new set of desirable ranges as a set of "zones" which can then be used for future patients.